Orchard and Garden

Benjamin Wallace Douglass

CHAS. C. B. MAYER

GA/GE
34973

HC15

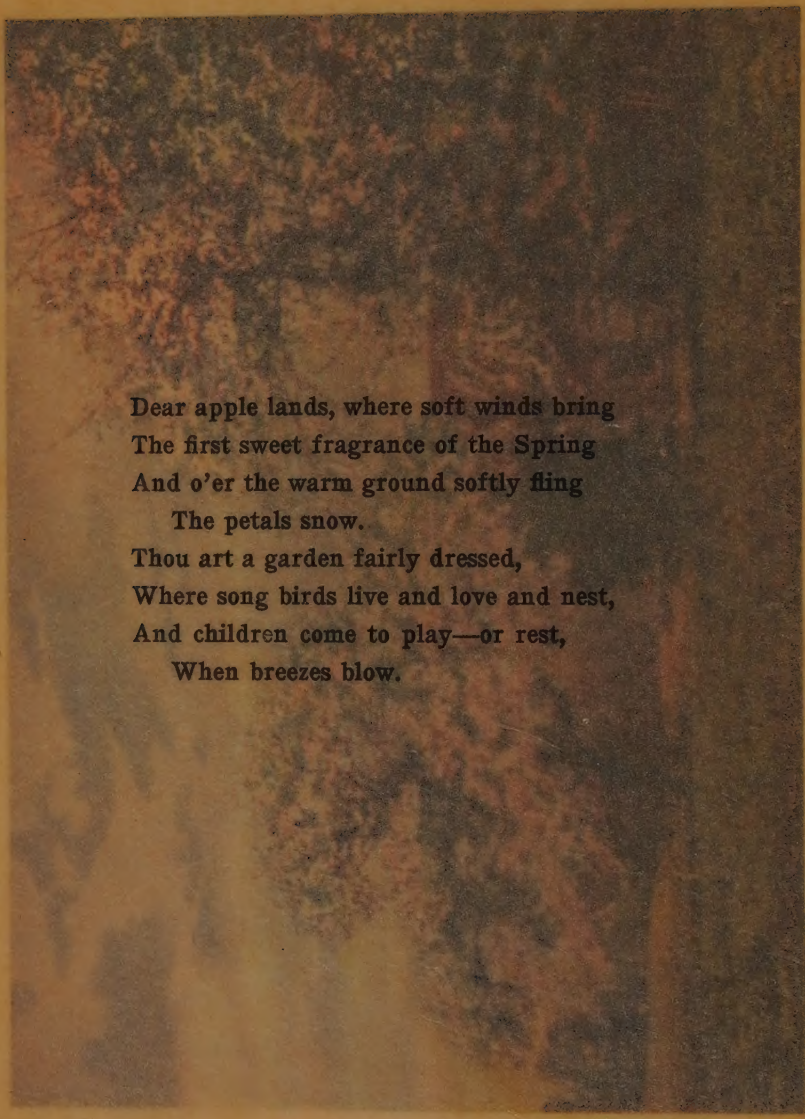
Orchard and Garden

A Guide Book for Beginners

BENJAMIN WALKER GLASS

1918
FEDERAL PUBLISHING COMPANY
INDIANAPOLIS

The Antiquarian Bookman
Ringe, N. H. 03461



Dear apple lands, where soft winds bring
The first sweet fragrance of the Spring
And o'er the warm ground softly fling
    The petals snow.
Thou art a garden fairly dressed,
Where song birds live and love and nest,
And children come to play—or rest,
    When breezes blow.

Orchard and Garden

A Guide Book for Beginners

BENJAMIN WALLACE DOUGLASS

1918
FEDERAL PUBLISHING COMPANY
INDIANAPOLIS

The Meeting School
Rindge, N. H. 03461

The writer desires to acknowledge the use of a number of photographs of school gardens furnished by Miss Rousseau McClellan, Director of Gardening in the Indianapolis Schools. Mr. C. B. Durham, Landscape Architect of Indianapolis, also furnished several pictures showing the use of shrubs around the home.

Copyright 1918,
Federal Publishing Company

Introduction

For a good many years, as State Entomologist of Indiana, I preached the doctrine of better fruits and better gardens and better farm crops. During the past six years I have been taking my own medicine—practicing what I had formerly preached. It has been a satisfaction to know that in most cases at least I "had the right dope" and in the places where theory did not accord with practice it has been a joy to work out new methods that would fit the case.

It is not claimed that the subject matter of this book is entirely new. Very few books are really new—they only state in new terms things that we have known before. However, what new material is presented is such that has been thoroughly worked out in actual practice and tested during a period of several seasons.

It is hoped that this book may prove a safe guide to the beginner and an inspiration to support him during the dark hours of doubt that come to all beginners in any field.

Owing to the scope of the subject treated and the limits of space, it has not been possible to digress very much from the main topics to dwell on the charms of life in the country and on the fascination of growing things. Farming, in any form, whether on a thousand-acre ranch or in a city back yard, is a creative industry and all creative industries are inevitably interesting. The man who paints a picture, or writes a poem, or grows a prize box of apples, or is the father of a fine baby, is each interested in his respective creation—vitally interested. The man who is selling city lots or automobiles or shoes, or is practicing law, or teaching school, is doing his useful work in the world, but at no time can he be as interested in his calling as is the man who is actually creating something new. The man who can make two blades

of grass grow where only one grew before is a wizard, but not nearly so much of a wizard as he who makes one blade grow where before there had been none. In this country we need both kinds. We already have some grass growing,—considerable in fact,—but we need more, and there are two ways to secure it. One is by doubling the present production, or at least increasing it (we can not all be wizards), and the other is by developing the waste places.

We have too much waste land, too many fence corners and abandoned farms and neglected pastures and half cleared timber tracts. We must learn to make use of the soil in its entirety and we must learn to use the same soil over and over again without appreciable loss of its fertility. We have been doing with our farms too much as the greenhouse man does with his benches—using one lot of soil for a limited time and then abandoning it and taking a fresh supply. We have moved west year by year to virgin soil and left behind us a trail of abused land. All of the land must be used and used intelligently—farmed, not mined of its fertility and cast aside.

These conditions are certain to come about in America. All of the land is going to be used to the best advantage. There is no question about it except the question of time. There is another question, however, that is not so settled and that is the question of who is to use this land. Will it be intelligent Americans, with insight enough to know that tilling the soil in one form or another constitutes one of the best "jobs" that an American can have, or will it be ignorant foreign laborers? Will Americans choose to become in fact a "nation of shopkeepers" or will they truly inherit the earth? American agriculture should be built up by and for Americans. Our forefathers in this country were an agricultural race and the national stamina that we have today is distinctly traceable to that old stock that developed its power by living close to the earth and breathing the clean air of Heaven.

Recent generations have shown a tendency to migrate to the centers of population. Farm boys have become lawyers and doctors and "captains of industry" and too often the father of the boys has followed them to the bright lights and

rented the farm to anyone who would pay him a grain rental. The father and the boys had been on such intimate terms with the real things that count in life that they had become callous to them just as the city man becomes callous to the smoke in the air and the pasty black muck on the pavements. They rented the farm on the basis of what it would produce in grain and overlooked all of the life-giving elements that were free for the taking.

On the other hand, we are beginning to see doctors and lawyers and even "captains of industry" returning to the land and, without exception,—and this is the encouraging part,—these city men invariably go to the country and remain there with far more enthusiasm than the farm folk exhibit when they move to town. The country, the open air, the hills, the sky and the smell of fresh turned earth, these are the real spice of life that make it worth the living.

You may ask if the country will afford the bread and meat of existence as well as the spice. That is a question that only the questioner can answer. Some people fail at everything, but the man who could make a success in the city can usually do the same in the country. There are exceptions of course. Some men would go mad in the country from the lack of noise—though the probabilities are they are already mad but no one has discovered it as yet. Some men have so completely sold their birthright that all they can see is their mess of pottage and their understanding fails to grasp the essential joys of country living.

For six years now, I have lived in the country. I have often wished that more of my friends lived near me, but never have I regretted that I had put the city behind me, as I hope, for the rest of my days. As for my friends, I know too well that they are inoculated with the idea of country life and only bide their time. So it is the hope that this book may serve to pass the inoculation along, as well as make it easier for those who already have the habit.

BENJAMIN WALLACE DOUGLASS,
Hickory Hill, Trevlac, Indiana.

December 17, 1917.

CONTENTS

PART I—THE ORCHARD.

CHAPTER I.

PLANNING THE ORCHARD.

Location—Roads—Relative position on the farm—High ground—Character of soil—Direction of slope—Water supply—Laying out the orchard—Fillers—Planting distances—Varieties—Pear planting—Plums—Cherries — Grapes—Strawberries—Raspberries — Currants — Gooseberries 1

CHAPTER II.

PROPAGATING FRUIT PLANTS.

Seedlings — Cross-fertilization — Horticultural varieties — Grafting—Root grafts—Top grafting—Budding—Cuttings—Layering—Pedigreed trees 15

CHAPTER III.

SOILS AND SOIL MANAGEMENT.

Drainage—Depth of soil—Orchard soils—Renewed fertility—Fertilizers—Cultivation—Dust mulch—Cover crops. 25

CHAPTER IV.

PLANTING THE ORCHARD.

Soil preparation—Selecting trees—Age of trees to plant—Staking the orchard—Dynamite—Inspecting trees—Planting 37

CHAPTER V.

PRUNING.

Need for pruning—Time to prune—Stubs—Painting wounds—Apple pruning—Pruning old trees—Pruning peaches—Plums and cherries—Pears—Grapes 45

CHAPTER VI.

INJURIOUS INSECTS.

Sucking and chewing insects—Codling moth—Lesser apple worm—Plum curculio—Peach borer—Apple borers—Currant worm—Grape moth—Canker worms—Bud moth—Yellow-necked caterpillar—Tent caterpillar—Pear slug—Bark beetle—Flea beetles—White grubs—Scale insects—San Jose scale—Scurfy scale—Oyster shell scale—Apple aphis—Peach aphis—Phylloxera—Leaf hoppers 59

CHAPTER VII.

PLANT DISEASES.

Causes of disease—Bacteria and fungi—Apple scab—Bitter rot—Black rot—Blotch—Blight—Sun scald—Illinois canker—Crown gall—Peach scab—Brown rot—Leaf curl—Peach yellows—Black knot—Leaf spot—Grape diseases 81

CHAPTER VIII.

SPRAYING

Need for spraying—Spray materials—Contact insecticides—Lime sulphur—Tobacco—Oil emulsions—Internal poisons—Arsenate of lead—Paris green—Fungicides—Stock solutions—Bordeaux mixture—Self-boiled lime sulphur—Dusting—Spray machinery—Nozzles—Power sprayers Winter sprays—Summer sprays 99

CHAPTER IX.

SMALL FRUITS.

Soils—Soil preparation—Time to plant—Strawberries—Raspberries — Pruning — Blackberries — Currants — Gooseberries—Novelties ---------- 119

CHAPTER X.

HARVESTING.

Picking—Time to pick—Picking peaches—Pears—Plums—Cherries—Grapes—Small fruits—Packing sheds—Apple packages—Box packing—Barrel packing—Peach packages—Plums—Grapes—Small fruits ---------- 131

CHAPTER XI.

MARKETING.

Uncertainty of conditions—Methods of marketing—Parcels post—Commission men—Association selling—Soft fruits—Apples ---------- 147

PART II—GARDENING.

CHAPTER I.

PLANNING THE GARDEN.

The family garden—Foreign gardens—Vacant lot gardens—Farm gardens — Soils — Location — Arrangement — Manure—Double crops—Fencing ---------- 155

CHAPTER II.

SEED SELECTION.

Flower parts—New varieties—Saving seed—Buying seed—Testing seed ---------- 165

CHAPTER III.

SPRING VEGETABLES.

Asparagus—Beets—Corn salad—Lettuce—Onions—Parsley—Parsnips—Peas—Spinach—Radish 171

CHAPTER IV.

SUMMER GARDEN.

Beans—Cabbage—Chinese cabbage — Cauliflower — Collards—Corn—Cucumbers—Egg plant—Kale—Muskmelon—New Zealand spinach—Okra—Peppers—Potatoes—Squashes—Sweet potatoes—Turnips 181

CHAPTER V.

SPECIAL CROPS FOR CANNING AND MARKET

Truck crops—Selling special crops—Soils—Canning crops—Home hampers—Tomatoes—Growing plants—Transplanting—Setting plants—Cultivating and fertilizing—Peas—Sweet corn—Potatoes—Scab—Seed potatoes Formalin treatment—Celery—Blanching 195

CHAPTER VI.

INDOOR GARDENING.

Greenhouse management—Forcing—Imitating out-door conditions—Soil—Watering — Hot-beds — Cold frames — House plants—Mushrooms 207

CHAPTER VII.

GARDEN INSECTS.

Chewing insects—Sucking insects—Cabbage worm—Corn ear worm—Stalk borer—Tomato worm—White grubs—Cucumber beetle—Flea beetles—Potato beetle—Squash bug—Harlequin bug—Plant lice—"Kaiser" bug.... 219

CHAPTER VIII.

HOME STORAGE OF FRUITS AND VEGETABLES.

General methods—Pits—Surface mounds—Cellar storage—Temperature control—Concrete cellars—Screens—Ventilators—Roof— Apples — Beets — Cabbage — Carrots — Celery — Onions — Parsnips — Pears — Potatoes — Sweet Potatoes—Turnips 229

CHAPTER IX.

THE BACK YARD GARDEN.

Present waste of good land—Patriotic gardens—The city garden—Lettuce—Spinach—Asparagus—Chinese Cabbage —The soil—Building up the soil—Its preparation for seed—Fertilizers—Cultivation of the growing crops—Vegetables for city cultivation—Asparagus—Beans—Beets—Cabbage—Carrots—Corn—Cucumbers—Kale—Lettuce — Onions — Parsnips — Peas — Potatoes — Radishes—Spinach—Squash—Tomatoes—Turnips. 241

CHAPTER X.

AN ORCHARD AND GARDEN CALENDAR.

A few timely suggestions for work to be performed in the orchard and garden during each month of the year... 257

CHAPTER XI.

THE VALUE OF A FLOWER GARDEN.

The ethical and economical value of flowers—America should be a land of flowers—Cosmopolitan character of the American flower garden—Planning the flower garden —Lawns—Soil for the lawn—The seed—Clover—Weeds—Vines—Large growing shrubs..... 281

CHAPTER XII.

ANNUAL FLOWERS.

Hardy annuals—Tender annuals—Soil—A list of satisfactory annuals—Acroclinium — Ageratum — Alyssum — Antirrhinium—Asters—Balsam — Calendula — Calliopsis —Candytuft—Celosia— Centaurea — Cosmos — Eschscholtzia—Euphorbia—Four-o'clock — Globe Amaranth —Helianthus—Helichrysum — Kochia — Larkspur — Marigold — Mignonette — Pansy — Petunia — Phlox Drummondii — Poppies — Portulaca — Rhodanthe — Ricinus — Salvia — Scabiosa — Stocks — Verbena — Xeranthemum—Zinnia—Vines—Balloon vine—Cobaea —Dolichos — Echinocystis — Humulus — Ipomoea — Nasturtium—Sweet peas ----------291

CHAPTER XIII.

PERENNIALS.

Permanent perennials—Soil—Propagation—Vines — Achillea —Anemone—Aquilegia—Asclepias—Aster—Campanula—Chrysanthemum—Coreopsis—Delphiniums—Dodecatheon — Hepatica — Hollyhocks — Iris — Linum — Lobelia — Monarda — Pentstemon — Peonies — Phlox —Physostegia — Rudbeckia — Tradescantia—Trillium — Verbena — Yucca — Dutch bulbs — Narcissus — Daffodils — Tulips — Perennial vines — Ampelopsis —Celastrus—Clematis—Lathrus—Wisteria -------305

CHAPTER XIV.

SHRUBS.

Value of shrubs—Native shrubs—Soil—Planting—Shrubs of known value—Amelanchier—Barberry—Calycanthus—Cercis — Cornus — Corylus — Crataegus — Cydonia

—Forsythia — Hamamelis — Hydrangea — Lilac — Philadelphus — Physocarpus — Rhododendron — Rose — Location — Soil — Planting — Spirea — Symphoricarpus—Viburnum—Weigela—Willow _____327

APPENDIX

Grafting wax—Number of plants to acre—Amount of seed to 100 feet of row—Packing table for apples_____351

PART I

THE ORCHARD

THE ORCHARD

CHAPTER I.

Planning the Orchard.

Location.—The first thing to consider in planting an orchard is the location. This subject must be studied from several different standpoints.

An orchard must be located close enough to the market that the fruit from the trees may be transported to the place of sale without too much expense. It is useless to attempt to grow fruit at such a distance from the market that the railroad charges will consume all possible profits.

Roads.—An orchard, then, should be located within reasonable distance of city markets and it must be located in a country where the roads leading to the railroad are sufficiently good that they will insure cheap and easy hauling. Bad roads are difficult for any kind of transportation and a load of fruit may sometimes be decidedly damaged by long hauling over them.

Relative position on farm.—The second point in regard to the location of an orchard is the selection of the actual site on the farm. Usually a spot can be found that is better suited to the growing of fruit than any other place on the farm. If the entire farm is located on high ground and in a climate where fruit-growing has proved profitable, then the entire farm might be converted into a commercial orchard.

In locating the position of the orchard the elements of

elevation, soil, slope, water supply and convenience to the home buildings must be considered.

High ground.—No orchard should ever be planted on low ground; select the highest land that is available. The reason for choosing this situation is that the high land is better protected from cold in winter and from frosts in spring. Cold air is heavier than warm air and settles to the lowest level, leaving the hill tops much warmer than the valleys. In general it may be stated that the difference in temperature will

The orchard road.

amount to one degree to every ten feet of elevation. This variation applies, of course, only when there is no wind. On windy nights the temperature will be about the same at the top of a hill as at the bottom, because all the air is stirred up and an even temperature results. Frost, therefore, seldom occurs on windy nights. Frequently a very slight elevation will make all the difference between a full crop of fruit and none whatever.

The character of the soil must be considered before the orchard is planted. Almost any soil will prove satisfactory for fruit growing except rich black prairie soil and the soil

of drained swamps. In general the richer the soil the slower the trees will be in starting to bear fruit. All forms of sandy soils are adapted to fruit growing and heavy clay loam soils are excellent. Pure clay soils are usually deficient in humus, that is, decayed vegetable matter, but this deficiency can be supplied by growing and turning under such crops as rye, oats, cowpeas, and clover.

The direction of the slope of a hill is of less importance in the location of an orchard than has sometimes been supposed. Formerly it was a common practice to plant orchards on north slopes with the expectation that such a form of planting would prevent the trees from starting into bloom quite so early in the spring and thus save the fruit from injury by spring frosts. It is doubtful if this theory will work out in actual practice. On the other hand a south slope will receive more sunlight and as a result the fruit will be better in color than it will on north slopes. In most hilly sections it will be found that the soil on the slopes toward the prevailing winds will be much poorer in quality than that on opposite slopes. For instance, if the prevailing winds are from the west, then the best soil will be found on the east side of the hills. The reason for this condition is that a large part of the fallen leaves are carried by the winds over the crest of the hill and deposited on the opposite slope where they decay and form part of the soil. This process being carried on year after year ultimately results in a very great improvement of one slope to the detriment of the other.

The question of water supply must not be overlooked in the location of the orchard. An abundance of water must be available even in the summer months so as to provide an ample supply for spraying purposes.

Near the house.—The orchard should be located as conveniently near the house as the other considerations will allow. An orchard filled with ripe fruit is always a temptation to the passerby; and, since it is not intended to grow fruit for the free use of the public, it is well to have trees so located

that they can be watched at all times. Convenience to the house will also often mean convenience to the water supply and also make it easier to gather the fruit. Incidentally, if the orchard is located where it can be seen every day, it will be a constant reminder that it should have its share of attention.

"Laying Out."—After deciding just where to plant the orchard, the question of how to plant it arises. There have been various methods of "laying out" an orchard and of

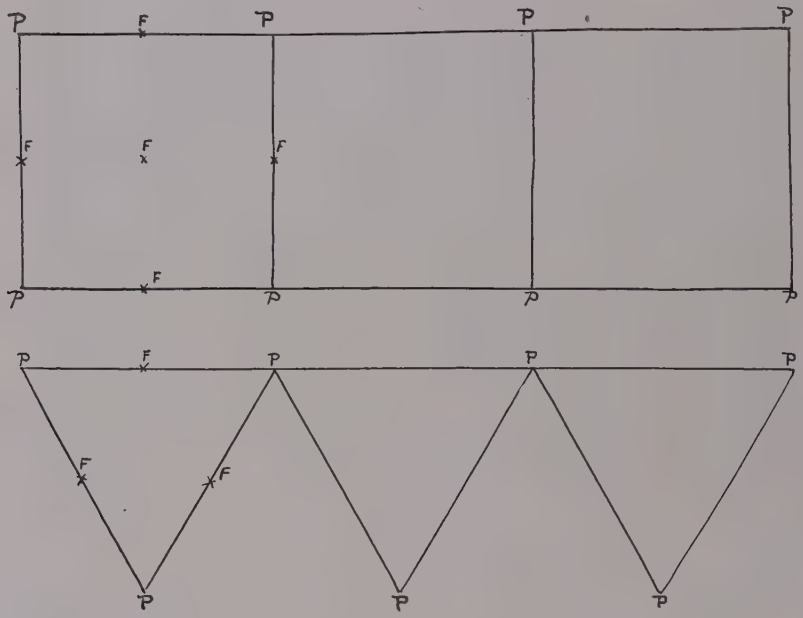


Diagram showing planting methods. P. Permanent trees. F. Filler trees.

these the commonest and perhaps the best is what is known as the square system. In this system the trees are planted equal distances apart and are located at the corners of an imaginary square. This method may be modified by planting a "filler" tree in the center of the square and sometimes this plan is still further changed by planting additional fillers be-

tween the permanent trees and in line with them. The triangular system differs from the square system in that the trees are planted at the corners of an equal-sided triangle

A six-year-old Winesap in Indiana.

instead of at the corners of a square. Thus the trees of the second row in the orchard will not come in line with the trees of the first row, but midway between them. This system is suitable only for level ground. All other systems of orchard

planting are simply variations of these two methods. The accompanying diagrams illustrate the two arrangements, while their application will be taken up in the next chapter.

Varieties.—In planning the orchard we must give a great deal of attention to the consideration of varieties. This is a subject on which the individual grower must be guided largely by the experience of other growers in his locality. If certain fruits have been a success under neighboring conditions, then it is a safe risk to plant those kinds unless it is known that the varieties in question are no longer in demand in the big markets. The Ben Davis apple can be grown successfully over a large extent of territory, but it is no longer planted to any degree, because growers have found that although they can grow Ben Davis apples to perfection, they can not sell that variety readily.

Fillers.—As a general rule, commercial fruit growers try to plant only those fruits that can be grown with a minimum amount of labor and that are at the same time of the highest quality. Some high quality fruits have faults which unfit them for the commercial grower; but they may be included in the list for the small home orchard, because such an orchard is not designed primarily to be a source of profit. It has been suggested that filler trees may be planted between the permanent trees of an orchard. For this purpose it is essential to select varieties which come into bearing at an early age. Frequently summer apples are planted as fillers, because many of them will bear fruit almost as early as peach trees. The early apples are also valuable to the orchardist in that they require less spraying and the crop is sold early enough in the season that the money can be used to pay the expenses of the main crop. Sometimes this consideration is of prime importance to the planter.

Peach filler.—Peaches, plums and cherries have been used as fillers, but their use is not to be encouraged unless the grower has had considerable experience in the management of orchards. There is always a tendency to let the filler trees

Stayman (Stayman Winesap), the most promising apple of the Winesap family.

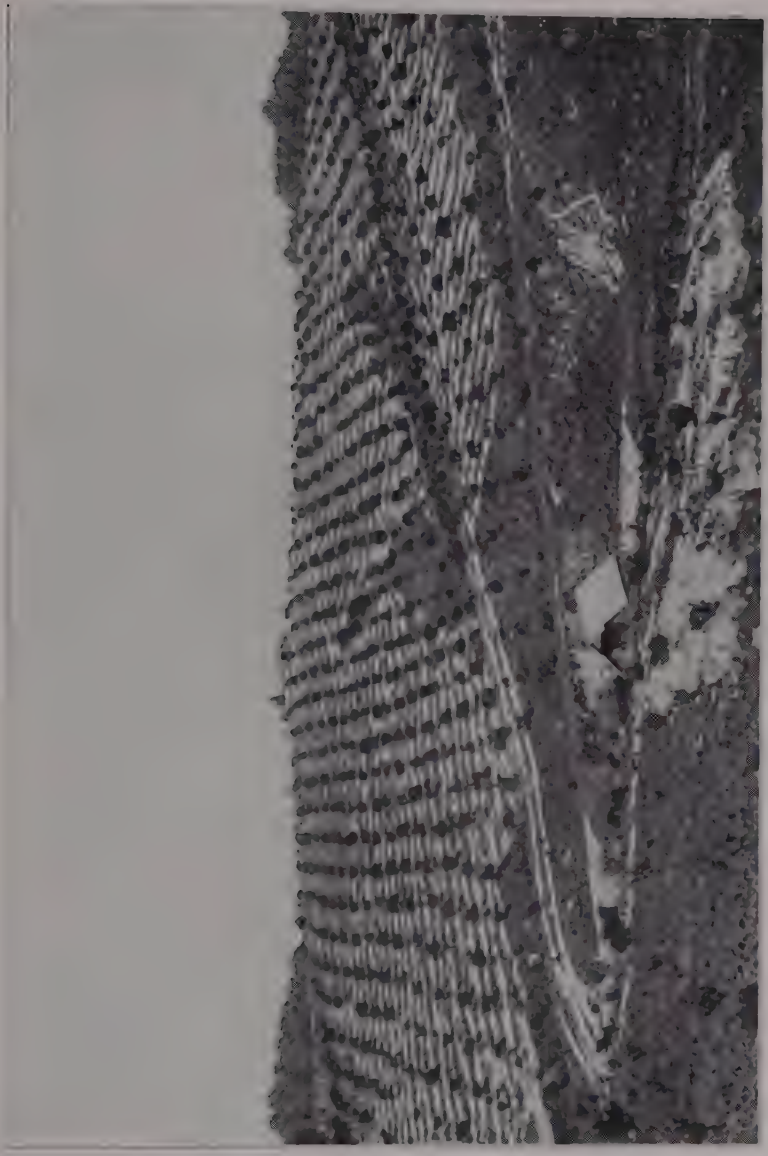
stand for "just one more season," and in this way they do considerable damage to the permanent trees.

Planting distance.—The following table shows the proper distances for planting the various fruit trees and small fruit plants.

Variety.	*Distance to Plant.*
Apples	40 feet
Peaches	20 feet
Plums	20 feet
Cherries	20 to 30 feet
Pears	30 feet
Quinces	15 feet
Grapes	8 to 10 feet
Currants	4 feet
Gooseberries	5 feet
Raspberries	3x6 feet
Blackberries	5x8 feet
Strawberries	4x4 feet or in rows four feet apart

Varieties.—It is sometimes possible to make an orchard pay its way by planting filler trees between the permanent trees, and then interplanting with berries or other small fruits between the filler trees. The following lists of varieties indicate in a general way what varieties of large and small fruits may be expected to succeed in the zone for which they are suggested. The north zone includes the New England states, New York, and the northern part of Ohio, Indiana, Illinois, Iowa, and Nebraska and the territory to the north of these states. The central zone includes the territory between the thirty-fifth and fortieth parallels of latitude, and the south zone includes all the country to the south of the central zone. The varieties listed are those that are considered suitable for commercial purposes.

The letter N, C and S after the name of a variety indicates the zone for which it is suggested. Apples for the extreme north are indicated by NN.



A large commercial orchard in a hill country.

Name.	*Zone.*
Akin	S. C.
Arkansas	S.
Baldwin	N.
Esopus Spitzenberg	N.
Fallawater	N.
Grimes	S. C.
Hubbardston	N. C.
Ingram	S.
Jonathan	C.
King David	C. S.
Northern Spy	N.
Northwestern Greening	N. NN.
Rhode Island Greening	N.
Rome Beauty	C.
Stark	C. N.
Stayman	S. C. N.
King	N.
Wagener	N.
Willow Twig	S.
Winesap	S. C.
Yellow Newton	N.
York Imperial	S. C.
Benoni	S. C.
Hibernal	NN.
Delicious	C.
Lowland Raspberry	S. C.
McIntosh	N. NN.
Oldenburg	S. C. N.
Patten Greening	NN.
Red June	S. C.
Wealthy	C. N. NN.
Yellow Transparent	S. C. N.

In general it is advisable to plant yellow peaches for market. A few local markets will take white peaches, but, as a rule, they are not in great demand regardless of quality.

Name.	*Flesh.*	*Zone*
Alexander	White	S.
Arp	Yellow	S. C.
Alton	White	S. C.
Belle of Georgia	Yellow	S. C.
Carman	White	S. C.
Champion	White	S. C.
Elberta	Yellow	S. C. N.
Early Elberta	Yellow	S. C. N.
Fitzgerald	Yellow	C. N.
Greensborough	White	S. C. N.
J. H. Hale	Yellow	S. C. N.
Health Cling	White	S. C.
Kalamazoo	Yellow	C. N.
Krummel	Yellow	C. N.
Ray	White	S. C.
Red Bird Cling	White	S. C.
Solway	Yellow	C. N.
Smock	Yellow	C. N.

Commercial pear planting is decidedly on the decrease on account of the difficulty of controlling the pear blight. This is a bacterial disease for which there is no known control. At times new varieties of pears have been offered by nurserymen who claimed that the new productions were "blight proof." So far all these wonderful new productions have failed to make good and the blight proof trees seem to die just about as quickly as the old varieties. Many of the blight

proof varieties were so poor in quality that they were worthless as commercial fruit. A few pears might by planted for home use, but the planter runs the risk of exerting himself uselessly. The following sorts are recommended if the orchardist feels that he must have a few pears: Bartlett, Lincoln, Seckle, Duchess, Comice, Sheldon, Kiefer.

Plums.—The following plum list is designed especially for the districts east of the Rocky mountains. On the Pacific coast there are certain places where it is possible to grow varieties that are not suited to Eastern conditions. Plums are among the most variable of our fruits. Some varieties have come to us from Europe and Western Asia, many from Japan and not a few have been developed from our native wild plum. The common blue Damson is said to have come from the old world city of Damascus and its present name is supposed to have been derived from the city near which it was first cultivated. Plums are of the easiest culture and will often grow where no other fruit

Well-grown Burbank Plums.

would survive. There is probably no place in the United States where some variety of plum could not be grown. The following list includes only varieties known to succeed in commercial orchards:

Name.	*Zone.*	*Name.*	*Zone.*
Abundance	S. C. N.	DeSoto	C. N.
America	S. C. N.	Lombard	C. N.
Burbank	S. C. N.	Wild Goose	S. C. N.
Damson	S. C. N.		

Cherries.—There are two general classes of cherries, known as sweet cherries and sour cherries. The sour cherry will grow almost anywhere, but the sweet varieties are much more difficult to produce to perfection. It is probable, however, that the sweet cherry will succeed in many more places than is usually thought, because it has not been extensively tested under modern methods of cultivation.

Sour Cherries—Early Richmond, Montmorency. These two sorts are excellent wherever cherries are grown.

Sweet Cherries—Black Tartarian, Lambert, Royal Ann, Schmidt, Governor Wood, Windsor.

Grapes are the poor man's fruit, because they will grow anywhere and with very little trouble. In some sections commercial vineyards are planted. In the East the commercial varieties are limited to a very few sorts. Concord, Campbell's Early, Catawba and Worden are among the best sorts planted for market. In a few districts Delaware is planted. It is a small but very fine red grape. The following list includes varieties worthy of the home vineyard, although some of them will not prove profitable.

Name.	*Color.*	*Zone.*
Herbert	Black	C. S.
Diamond	White	C.
Niagara	White	C. N.
Lady Washington	White	C. S.
Brighton	Red	C. S.
Brilliant	Red	C. S.
Woodruff Red	Red	C.

Strawberries.—It is impossible to give definite lists of strawberries in a book of this sort for the reason that varieties of this fruit do not give equal satisfaction in sections often only slightly removed from one another. Then, too, there is no other fruit in which kinds go out of fashion so promptly and generally as in the cases of the luscious strawberry. New and excellent varieties are being introduced

A two-year-old vineyard.

every year and the student of fruit culture must study nursery catalogs and consult with his berry-growing neighbors before he can decide what will probably succeed on his ground. To give a list of sorts suitable for different places would mean several different lists for nearly every state in the Union. If there are no successful berry growers in your section, it is advisable to plant a number of varieties and watch their growth a year or two before trying this fruit on a commercial scale.

Raspberries.—A list of a very few varieties will cover all the commercial sorts of this fruit. The black varieties of raspberries that are universally planted are the Cumberland and the Kansas. The Hoosier, a new kind, is attracting much attention and may prove better than the two former. The Cuthbert is the most widely planted of all the red berries and the Columbian and Haymaker are the best purple sorts. White or yellow raspberries are seldom planted except as novelties. The St. Regis, an ever-bearing red variety, is proving to be an excellent sort. It bears all through the summer and is a decided addition to our list of fruit.

The Blackberry will succeed over a wide range of territory. This popular bush fruit grows wild in many places and in a few localities great quantities from this source are gathered and shipped each year. Among the most popular cultivated varieties are the following: Early Harvest, Eldorado, Snyder, and Wilson.

The Currant will thrive on many soils, but will not endure dry weather well. As far as climatic conditions are concerned it will survive great extremes of temperature. The sorts most widely planted are London Market, Perfection and Wilder. The best black variety is probably Black Naples and the best white sort is the White Grape.

Gooseberries.—The Houghton is probably the most widely planted of any gooseberry, but there are some promising new sorts that will undoubtedly become prominent before long. The English varieties are quite subject to mildew and are not regarded as profitable, although the fruit is superior.

CHAPTER II.

Propagating Fruit Plants.

Seedlings.—All fruit plants produce seeds of some sort and from these seeds new plants can be grown. These new plants, however, are very seldom as good as the original plant that first produced the seed. For instance, the seed from a Grimes Golden apple will not be apt to produce fruit that even remotely resembles the parent fruit. For this reason fruit growers are forced to resort to artificial methods of perpetuating their varieties.

There has been a tremendous amount of experimental work done looking toward the production of new varieties of all sorts of fruit. Some of this work has been productive of results, but much of it has been in vain. Nature does not seem to respond readily to attempts at improving on her handiwork. She is slow in her methods, but ultimately sure. Out in Iowa nature took things into her own hands and in an old orchard produced a seedling tree that bore the first "Delicious" apples. This apple, probably the best single variety in existence, is a chance seedling. On the other hand, in Indiana the State Horticultural Society tested more than ten thousand carefully selected seedlings and out of the entire lot did not secure more than half a dozen apples that seemed worthy of further testing—none of them to compare with the chance work in the old Iowa orchard.

Cross fertilization.—One reason that the seeds of a fruit fail to produce similar fruit is that the seed has been fertilized by pollen from some other variety and as the two varieties mix they produce something that is entirely differ-

ent from either parent. This mixture of qualities might be compared to the mixing of certain pigments. A yellow and a blue paint when mixed will produce a green color. The green does not in the least resemble either of the colors that were used to produce it. Different kinds of blue or yellow will produce different sorts of green and even the expert painter must experiment with each particular batch of green in order to match a previous shade. In the mixing of pollen the same mixture will seldom occur twice and, therefore, it is rare that any two seedlings will even remotely resemble each other.

Horticultural Varieties.—It must be remembered, too, that all our fruits are very much improved over the wild form. Our common varieties of cultivated fruit are what are known as "horticultural" varieties; that is, they are not true varieties as found in a wild state, but they are kinds that have been improved by much careful, patient work on the part of plant breeders.

All these so-called horticultural varieties have a decided tendency to revert to the original type from which they were developed. Their development has been simply a matter of selecting the best seedlings from time to time. The original wild apples of Europe were carefully watched for generations, and whenever a better sort was found, that particular sort was taken by the fruit grower and carefully tended. In time perhaps it was found to have produced a new seedling that was still better than its parent. In this way the development of varieties has progressed for many years. Great advance has been made in America in the evolution of new sorts of fruit during the past century.

American Grapes.—Many, if not most, of the grapes grown in the eastern United States have been developed from native vines that formerly grew in the American woods. The widely planted Concord is simply a chance seedling of the native wild Fox grape that still grows over New England and westward to the Central states.

Since we know that these improved varieties do not

reproduce themselves from seed, we are ready to consider the methods that are employed in their propagation.

Grafting.—The chief means of growing fruit is perhaps that of grafting. In this process a twig or scion of the desired variety is inserted in a stock of some common sort or into the root of a seedling. Accordingly grafts are spoken of as root grafts or top grafts.

Root graft.—The root graft is used mostly in propagating the apple and similar fruits. Top grafting is used in top working orchard trees to change the variety and in a few cases to improve the tree qualities of a variety. Some varieties that are otherwise excellent have poor root systems. This statement is true particularly of the Grimes. In order to improve the tree, it is customary to graft a Grimes scion on a young tree of some vigorous sort.

Top grafting a young apple tree.

Various methods are employed in making grafts. The method used in the preparation of root grafts for nursery stock is commonly called whip grafting. A small, one-year-old apple seedling is selected and the top is cut off with a smooth long cut. This operation leaves the top of the root with a beveled end about an inch or an inch and a quarter long. This bevel is then split the long way of the root for a distance of about three-quarters of an inch. A scion of the desired variety is

next selected and a piece of twig of last year's growth is cut such length that not more than two buds are included. The lower end of this scion is cut exactly as the root of the seedling was cut. The two beveled and cleft pieces are then fitted together and the union is tightly bound with a bit of waxed yarn. This work can be done in a warm place just at the close of winter and the prepared grafts packed in moist sawdust until the ground is in fit condition for planting. As soon as the ground can be worked easily the grafted seedlings are planted in rows about three or four feet apart and about six to ten inches apart in the row. They should be planted so deep that just one bud will be above the surface. Constant cultivation throughout the summer is required in order to insure a vigorous growth.

In top grafting the process is similar; but, since a young scion is inserted in a much older stock, some preparation must be made to prevent the loss of moisture through the large exposed wound. In the case of the root graft the wound was covered with earth so that very little moisture was lost.

Apple tree showing the growth from grafts in one season.

After selecting the tree to be grafted, the branches should be cut back with a sharp saw and only the stubs left. If it is not desired to insert grafts in all the main branches, part of them can be left during the first summer and removed after the grafts are well established.

First split the stub of the branch with a sharp tool for a distance of from an inch and a half to two inches. Then select the scion and cut the lower end to a wedge shape about an inch and a quarter in length. This wedge should be slightly thicker at one side than at the other, and at the base of the thick side of the wedge should be one of the three buds. Then pry the split stub open far enough to admit the wedge of the scion. In inserting the scion be sure to place it with the thick side of the wedge, on which the bud is located, to the outside of the stub. Also be sure to see that the inner bark of the stub and of the scion exactly coincide. It is from the line between the inner and outer bark that the new growth starts, and unless these lines are adjusted exactly, the graft will make a poor growth.

A grafted apple tree one year after grafting (natural size)

After the graft is finished the stub of the tree should clamp it tight enough to hold it firmly. It is then ready to be waxed. This operation is done by covering all the cut surfaces with grafting wax, which should be applied evenly over the cut end of the stub and extend down the split sides as far as the bark is broken even slightly. The top end of the scion should also be carefully waxed to prevent the loss of moisture from that point. This precaution may seem trifling; but, if one should ever try to make a graft grow without this bit of waxing, it will soon be seen how very important it is to heed such advice.

Budding is the term applied to a certain form of graft-

ing, because it involves the use of buds instead of the use of scions. Budding is a very easy method of propagation and is employed in relation with practically all fruits, including even those that are more often grafted. Peaches and other stone fruits are almost always budded.

Apple tree two years after grafting.

In nursery work it is customary to plant the seeds of peaches in the fall of the year or very early in the spring. By early summer the young seedling trees are large enough to bud. The buds are secured from trees of known variety and are cut in the form of "bud sticks," which are simply twigs of the present season's growth from which the leaves have been clipped. The buds are always located just above the

base of the leaf and in the angle which the leaf makes with the stem. In removing the leaves it is customary to leave a short piece of the leaf stem by which to handle the bud more conveniently. The bark on the seedling tree is split with a sharp knife and laid open so that the clean white wood is exposed. Then a bud is removed from the bud stick and inserted under the bark of the seedling. In this way the bark surrounding the bud is brought in contact with the wood of the seedling. The flaps of seedling bark are tightly bound around the bud to hold it in close contact with the wood. After ten days or two weeks the cords binding the bud are cut, because, at that time, the bud and the wood should have grown together and further use of the bindings might injure the tree. In cutting the bud from the bud stick be careful to remove the wood from the bud. Sometimes in cutting the buds the wood has a tendency to adhere to the bark and in such cases it is difficult to secure good results. In moist weather the buds will slip from the stick easier than in prolonged dry weather.

A four-year-old peach tree, showing the growth which was made from three buds inserted the year before. Lines indicate where buds were inserted.

This bud will not grow during the summer in which it is inserted. Early the next spring the nurseryman cuts off the old seedling top at a point just above where the bud was inserted. When the growth does start it must start from the single bud; as a result, this bud forms the young tree.

Budding is not so often practiced in top working trees, because it is difficult to secure good results with this practice even on trees four or five years old.

Cuttings.—Another method of propagation is by the use of cuttings. The cuttings are simply twigs, usually of the previous season's growth, and they are induced to grow by planting them quite deep in the earth. Only one or two buds should show above the surface. It is from these buds that the new plant is formed, while the buds below the surface provide points from which new roots develop. This method is not usually employed by nurserymen except in the case of grapes, currants and gooseberries. Other fruits do not form roots readily from cuttings.

Grape cuttings.

Layering.—Still another means of increasing the numbers of a certain variety is by the practice of layering. In this case a shoot or branch of the plant desired is bent down to the ground and a section of the stem is covered with earth. Under this mound of earth new roots will form and ultimately the bent stem may be severed from the parent plant and the new individual taken up and transplanted elsewhere. This practice will work nicely with grapes, and it is used almost entirely in the propagation of raspberries and strawberries. In the case of strawberries, this system is the natural one by which means the plant is enabled to spread rapidly. The "runners" of the berry plant are shoots which, on being brought in contact with the soil, develop roots and start a new plant.

Dividing the roots of certain plants is another manner of propagating, but it is not largely used in fruit growing, because so few plants lend themselves to this method.

Effect of Stock on Scion.—It will be noticed in all methods of propagating that the process is purely a vegetative one; that is, the question of seed does not enter into consideration at any point. When a scion is taken from a certain apple tree and made to grow by being placed in the root stock of some inferior seedling, that scion and the tree which it may make are not altered in the least. If the scion is taken from a Baldwin tree, the resulting tree is certain to be a Baldwin and to produce fruit exactly like the parent tree. Of course, it is assumed that the soil and climatic conditions are the same in each case. But nothing has been done to that scion to change its character in any way, and the fruit is bound to be just as good, but no better, than that produced on the tree from which the scion was taken.

"Pedigreed" Trees.—These considerations are of interest because there are always people who attempt to deceive the public by offering what they are pleased to term "pedigreed" trees. A pedigree always implies two parents. In fruit tree propagation no real parent exists. The business of propagating is a scheme of the horticulturist to induce the tree to make a more extended vegetative growth. Under such conditions any talk of possible pedigree is foolish. A seedling apple might be said to have a pedigree, but it would be of one generation only, with a mother of one sort and a father of another, which would mean very little in horticultural values. Under no condition could a budded or grafted tree be said to have a pedigree.

Conclusive Proof.—The Purdue Agricultural Experiment Station has recently published the results of many tests along this line and all of their experiments tended to show that bud variations in apple stock were very rare. The following extracts are from the report on this work, which was done by Mr. Joe A. Burton:

"One of the first things undertaken in the experimental orchard was to graft Yellow Transparent and Chenango on a wild crab to observe the influence of the stock on the scion.

When these scions set fruit all the leaves were removed from the graft and the apples were compelled to grow from sap elaborated by the crab leaves. The fruits were perfect specimens of Transparent and Chenango."

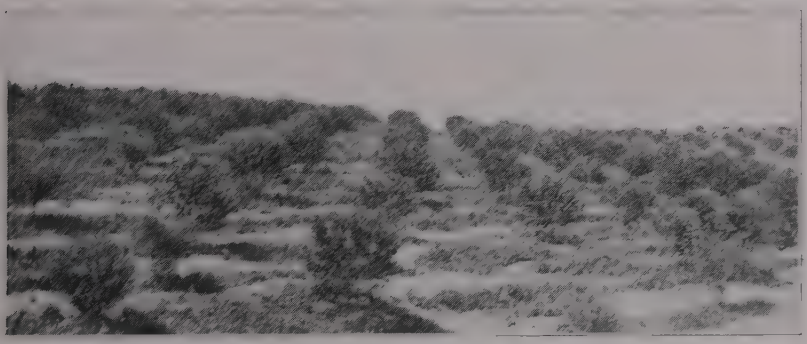
"As regards the variation in size and color of fruit, scions were grafted from Rambo trees which grew very large and fine fruit; and another lot from trees which grew small and inferior fruit; also scions from Ben Davis, which grew highly colored fruit and some from trees which grew poorly colored fruit, were top-worked on the same tree. When brought together on the same tree, the fruit from scion wood from trees producing large sized and highly colored specimens were indistinguishable from the fruit borne on the scions which had been taken from trees which grew small and poorly colored fruit. This was repeated in practically the same manner with Ralls with results verifying the above.

"These tests in the opinion of Mr. Burton would seem to indicate that the observed variations between varieties is probably due, in almost every case, to environment rather than to bud variations."

CHAPTER III.

Soils and Soil Management.

Drainage.—There is one quality that any soil must have if it is to be used for the production of fruit. It must be well drained. All varieties of fruit are injured if they are subjected to the discomfort of "wet feet." If the natural surface of the land is not such as will cause all surplus rain to run off, then some provision must be made for drainage. A very simple and cheap method of drainage is to plow the



A hillside orchard cultivated in strips.

land so that a "dead furrow" will come between the rows of trees. This will form a shallow ditch which will carry off much of the surplus water. This plan has some serious objections, but it has been successfully used by practical fruit growers.

Tile drainage.—A better, but more costly, way to drain is to install a tile system throughout the orchard. Tile

should be placed not less than thirty inches below the surface and on some occasions deeper. It must be remembered that the proper placing and laying of a drain is a matter generally requiring expert attention. The planter would better consult some local authority who not only knows the character of the soil in question but who also has had experience in laying tile in that particular kind of soil.

Depth of soil.—The expression "depth of soil" is sometimes used in speaking of particular pieces of land. This term usually means the depth of that portion of the soil which is capable of growing crops. Often a soil may be several feet deep before rock or gravel is encountered, but more frequently only the few inches of top soil are fit for agricultural purposes. The deeper soil can be made available by deep plowing or by the use of dynamite in some conditions. A deep soil usually has more plant food in the form of available chemicals, than a shallow soil. Deep soils also act as sponges to take up and retain moisture during the growing season.

Orchard soil.—As a rule the same high degree of fertility is not desired in orchard soils that is so important in general farming soils. Fruit trees planted on such rich land will make a rank growth, but will be slow in starting to bear fruit. Such trees, too, are more liable to be injured by some of the plant diseases than are trees that have made a more normal growth. This statement is particularly true of the blight of pear trees.

Orchards on poor land.—On the other hand, it would be unprofitable to plant an orchard on the poorest land to be found. Some ground is too barren for any agricultural use. Extremes in both situations must be avoided. Many persons do not stop to consider that a crop of fruit removes certain chemical elements from the soil just as surely as a crop of corn or wheat removes other elements. It has long been a popular notion that orchards do not require fertilization, and this idea seems to account in some measure for the many

A young orchard well located as to drainage and exposure

neglected and deserted old orchards to be found over the country. The trees simply used up all available plant food, and when the supply was exhausted, they naturally failed to bear any more fruit. The chemical elements in most soils are of two classes, that is, available (ready for use) and unavailable materials. There is nearly always much more unavailable matter than that which is ready for the plant to use.

A cover crop of rye in a young orchard.

Renewed fertility.—By the action of roots, by the decay of leaves, and by the action of frost and air, the unavailable material is slowly made over into the other form which the plants can take up and use. In the case of old orchards that have ceased to be profitable, it is often surprising to find them unexpectedly producing a fair crop. This apparent exception means that while the old trees have been marking time for a number of years, the available chemical elements

in the soil have been accumulating until they reach a point where they are able to force the trees to bear another crop of fruit.

Fertilizers.—In modern practice the wise orchardist anticipates this demand on the soil and provides his trees with the chemical elements which they need before they begin to slacken in the production of fruit. It is impossible to lay down rules for the fertilization of orchards, because the chemical needs of different soils will vary with the different localities. In fact, different soils within the same orchard will often have different fertilizer requirements. The best way to determine what to use is to start an experimental block of trees and use several different mixtures in order to decide just which fertilizer provides most nourishment.

Barnyard manure.—As a rule, it is well to avoid the use of barnyard manure, because in many instances it has seemed to induce root trouble. A few good orchardists use it, however, and apparently have no annoyance. In any event, if manure is used, it should never be applied close to the trees.

The three elements that are usually found in all commercial fertilizers are potash, nitrogen and phosphorus.

Potash is mined in Germany in large quantities and practically the world supply formerly came from that country. This element is also contained in unleached wood ashes. In order to secure this element, orchardists have scattered ashes over the surface of the ground for many years. Potash is now obtained from sea weed and recent investigations indicate that we have in our southwestern states deposits that rival those of Germany.

Nitrogen is found in the soil in the form of nitrates, of which there are several different kinds. The name itself simply means that the nitrogen, which in its pure state is a gas found in the atmosphere, is combined with some other element. For instance, nitrate of soda is a chemical in which sodium, nitrogen and oxygen are combined in given proportions. Although nitrogen is a common gas, and is to be found

everywhere in the air about us, it is of no value as a plant food unless it is chemically combined with some other element. Certain kinds of bacteria have the power to take the atmospheric nitrogen and combine it with other elements, thus making it available for the use of all plants. These particular bacteria are found growing on the roots of clover and similar members of the bean family. Wherever they grow on the clover roots they form small nodules or lumps. When the clover plant dies or is plowed under, these nodules decay and liberate a very considerable amount of nitrogen in the form of nitrates. This method of securing nitrates in the soil by the growing of clovers is an almost universal practice in general agriculture. It is by far the cheapest means of supplying nitrogen to the soil.

Phosphorus as an element of commercial fertilizers is found in the form of a soft rock in some of the Southern states. In this form it is combined with other elements just as the nitrogen was combined in the case of nitrate of soda. The use of phosphorus as a fertilizer element appears to be increasing in most sections.

Cultivation.—Any orchard that is worth planting is worth cultivating. Fruit trees respond to cultivation in just the same way that corn or potatoes answer to attention. No good farmer would attempt to grow a crop of corn without thorough cultivation, but these same good farmers sometimes think that an orchard needs no care from the time it is planted till it begins to bear fruit.

Orchard cultivation should start in the spring just before the time when rye or wheat is starting to head out. These two grains are often used as cover crops in orchards and just before they start to head they should be cut up with a heavy disc harrow. The use of the plow is not necessary in most orchards, and, in fact, may cause some injury by cutting the roots of the trees. The disc stirs the soil just deep enough, and, unless the rye is permitted to grow too tall, the disc will turn it under sufficiently. After the orchard has been

Nitrogen nodules on roots of clover.

(3)

gone over with the disc in at least two directions, it should be ready for some tool which will still further pulverize the surface. Any kind of harrow is good for this purpose, but most orchardists use either a spring tooth or one of the patent Acme harrows. The latter is designed especially for orchard work and is a very excellent tool. A common board drag will help to keep the top soil pulverized and in a good state of tillage.

The chief object of cultivation is to retain moisture in the soil. This is done by forming what is known as a dust

The dust mulch.

mulch over the surface. The dust mulch acts like a great blanket of felt laid over the orchard. Very little moisture can escape from the soil if the surface is protected by such a mulch. In a well cultivated orchard damp earth should be reached easily by heaping up some of the mulch with the toe of the shoe. To emphasize this point, go into an uncultivated field with a pick and shovel and find how deep one must go before reaching moist dirt.

Cultivation also kills all weeds. Since weeds need moisture in order to grow, it is reasonable to expect that, if they

are kept down, more moisture will be conserved for the use of the trees.

Dust mulch.—Any rain that might fall on a dust mulch will be gradually absorbed and a paste will be formed, which, if permitted to dry, will cause a crust over the soil. As this condition is exactly the one not desired, cultivation must continue, especially after each rain or even shower. By this

Clean cultivation in a young orchard.

means the dust mulch is kept in good condition to protect the soil moisture for the sole use of the trees.

Cultivation should be stopped about the middle of summer in order to give the trees opportunity to harden their wood before the approach of winter. If the trees were made to grow till frost—which might easily be done—the newest growth would be found too tender to survive the cold weather.

Cover crop.—At the time cultivation is stopped a cover crop should be planted. This crop still further checks the

Cracks in uncultivated ground during dry weather.

growth of the trees and also furnishes a protecting cover for the ground during the winter. Land so sheltered will not freeze as deep and will also catch and hold the snow better. The snow itself is, of course, a protecting cover for the ground, and, as a result, the roots are less likely to be winter injured. Another function of the cover crop is to prevent the soil from washing away in winter. On hillsides this washing process may become a very serious problem which may necessitate planting the cover crop somewhat earlier to insure a heavier ground protection. In neglected orchards such erosion of the land has sometimes ruined a fine planting in one winter. Any of the winter grains, such as rye, wheat or barley, will make a good orchard cover. Rye is especially good because it makes a sturdy growth and is quite hardy. In some sections crimson clover can be planted with the rye, thus affording the benefit of the rye as a protection and of the clover as an aid to fertilization. Winter vetch can be used in this same way. It must be understood that these cover crops are not planted as a source of direct profit. It is most unwise to attempt to take a crop of grain from land between the trees. It simply means stealing some of the fertility from the soil, which in order to insure a profitable orchard, must be replaced in some way later.

Throughout the entire subject of soil management we must not lose sight of two facts. The first is that by good cultivation we retain moisture for the use of the growing plants. The second is that any crop that is harvested removes something from the soil which must in some way be returned. If it is not returned, then it is but a question of a short time until the soil becomes "worn out" and unproductive. In America we have been too much inclined to mine our soils rather than till them. Starting with a natural rich soil, we have taken crop after crop from the same piece of land with no attempt to return some of the fertility we have each year removed.

It is for this reason that we find in our older sections "abandoned farms." Most of them should never have been

abandoned. Many of them are even now being reclaimed. An abandoned farm in Massachusetts was bought by a modern cultivator who was willing to give the soil a fair chance. It took him about two years to get the old place back to such shape that it could be profitably handled. After that time he regularly harvested ten bushels of potatoes to the acre on land that had been abandoned because it was unproductive.

There are very few places on the face of the earth where the soil is so poor that it can not be made to yield a crop of some sort and even the poorest land and that which has long been neglected responds to intelligent care with a bounteous fruitage. That is at once the surprise and the delight of the agriculturist.

CHAPTER IV.

Planting the Orchard.

Soil preparation.—Many orchards are planted on poorly prepared land, but in order to secure the best results the preparation of the soil should be considered as of vast importance. As a rule, the best preparation consists of fall plowing when the trees are to be planted in the spring following. Then as soon as the ground can be worked it should be gone over once or twice with a disc harrow. It should next be smoothed with a drag or spike tooth harrow. Except in the South, the best time for planting nearly all fruits is in the spring. When planted in the fall, trees frequently perish unless the succeeding winter proves mild. However, spring planting should be done early—the earlier, the better.

Selecting trees.—Trees should be selected just as early in the season as possible. In fact, it is better to buy stock in the fall, and have the nursery man deliver it early in the spring. In this way the planter has the privilege of selecting the best, while if he waited until later in the spring he would have to take what was left. If the trees arrive before the ground is ready for planting, they should be carefully unpacked and heeled in. Heeling in is just another name for deep planting. A trench should be dug on the side of a hill, with the lower end left open to afford the best drainage possible. Place the trees in this trench, with their tops slanting to the southwest. Fill in the trench, covering the trees with earth so that only a part of the tops show above ground.

Trees can also be heeled in temporarily in the spring by placing them flat on the ground and shoveling some earth over the roots. But this method is not sufficient if trees are to remain so all winter.

Age of trees to plant.—In selecting trees for the orchard always select one-year-old trees. They are the best from every standpoint, and will prove more satisfactory than trees of any other age. This statement applies to all varieties of fruit trees. Small fruit plants are always sold when one year old. Some of the advantages of buying one-year-old trees are

A nursery storage house where trees are kept over winter.

that they will stand transplanting better, that the grower can prune the heads of his trees to suit his own tastes, and that the cost of freight on a shipment is much less than for older trees. It is often thought that an orchard can be made

to bear earlier by using two- or three-year-old trees, but such is not the case. A one-year-old tree will get its bearings so much more quickly that it soon outstrips its older neighbors.

Staking an orchard.—The orchard was planned in a previous chapter and now comes the actual realization of putting those plans into practice. First of all, a base line must be established as a starting point. A base line is simply a line of stakes set the given distance apart, with all of them in a perfectly straight row. A surveying instrument is very convenient in establishing this base line. With its help a straight line can be quickly located. Then a right angled turn is made and a parallel line of stakes set. With these two lines of stakes placed it is an easy matter to set up tall sighting stakes along the rows where trees are to be placed. Individual stakes are not required for each tree. The holes are dug in line with the sighting stakes and the required distances apart. Then the planter follows and sets the trees in the holes; and, as he does this he can easily sight back to the old sighting stakes and in this way keep each tree exactly in line with the rest. This system has been used in some of the largest commercial orchards in the country. While it is not as accurate as is sometimes deemed necessary, it is sufficiently good for any real need. After the trees have been set a short time, some of them are always sure to lean a trifle, so they can really not be expected to remain in perfectly straight rows.

Planting an orchard. One man unpacks and trims roots and tops. Another is seen dipping the roots in a thick paste of mud, while a third is just starting out with a bundle of trees.

Another method of staking an orchard is with the help of a long wire. This wire should be long enough to reach entirely across the field to be planted. If trees are to be planted twenty feet apart, a small copper band should be soldered to the wire at twenty-foot intervals. In practice this wire is stretched across a field and a stake set for each tree at the points where the copper bands are soldered on. After the first row is set, the wire is moved over the desired distance at each end and another row of stakes placed.

Digging the holes; Dynamite.—In digging the holes care should be exercised to make them large enough to accommodate all the roots without cramping. The topsoil should be piled at one side of the hole and the subsoil at another. The use of dynamite has been suggested in connection with the planting of trees and the mistaken idea is prevalent that with its use the cost of digging holes is eliminated. As a matter of fact, more time and labor are necessary to dig a proper hole for tree planting when dynamite is employed than otherwise. If dynamite is used, a hole is bored at the place where the tree is to be planted and a small charge of powder exploded about thirty inches under ground. The surface of the ground should not even be blown away by this explosion, but simply heaved a bit, with the topsoil loosely piled up and no opening visible. Then a hole must be made with a spade just as if no dynamite had been used. In addition to the labor of digging an ordinary hole, the planter must dig to the bottom of the blasted area to

An example of improper planting. No air space should be left. (After Wallace.)

Planting with dynamite. Inserting the charge.

make sure that no air cavity has been left by the explosion. If the ground is even moist when dynamite is used, a hard walled pocket will be left at the point of discharge. A careless planter might easily set a tree over this air pocket and would wonder what caused the tree to die during the first dry weather.

In soils having a stiff "hard-pan" below the surface a short distance, the use of dynamite is advisable, but must never be used when the ground is wet. It is a good plan to prepare the ground for tree planting by using dynamite in the places where trees are to stand, providing the work can be done during the dry weather of the summer previous to the actual planting. The use of dynamite in the spring is almost always a mistake.

The blast.

Inspecting trees.—When the ground is ready to receive the trees, they should be unpacked or dug up, as the case may be, and one man should be given the task of examining each tree and pruning the roots preparatory to planting, which is just as important as pruning the tops afterward. Each tree

should be taken up separately, and examined root, stem, and branch for insects and mechanical injuries. If many trees are found defective, they should be saved out and the grower should refuse to pay for them. It is against the law for any nursery to sell defective stock, and no buyer who permits an unscrupulous dealer to impose on him is doing his duty.

Pruning the roots.

All broken roots should be pruned to a smooth, clean cut, and in the case of the apple, all small fibrous roots should be pruned entirely away. These small roots are usually matted together and when the tree is planted they frequently die and cause the tree to suffer or perhaps perish from the disease known as root rot. It has been found that, if these small fibrous roots are taken away, the possibilities of avoiding root rot are greatly increased.

Planting.—After the trees are inspected, and the roots are pruned, they are dipped into a thick paste made of earth and water. This gives the roots a coating of mud and prevents their drying out before they are planted. The planter sets the tree in the hole prepared for it and arranges the roots to the

best advantage. If the hole is not large enough for this purpose, it should be enlarged to suit. The topsoil is then thrown about the roots of the tree and tramped down as firmly as possible with both feet. More soil is added and again tramped solid. But the last soil placed around the tree should not be tramped down, but should be scattered in loosely. After the tree is planted it is a good idea to try to pull it up with the hands, and if it gives too easily it should be planted again more firmly, in order to be a well planted tree.

Planting small fruit.—The general principles just described apply to the planting of all trees and nearly all fruit plants. Strawberries especially require great care in planting.

Planting with dynamite. Boring the holes.

The young plants as they are received from the nursery always have plenty of leaves and more roots than they possibly need. The plants are tied together in bunches and the roots of an entire bunch can be cut with one blow of a hatchet. All the older leaves should be removed also. As a rule, about one-third to one-half of the roots should be removed from strawberries. The plants are set out by pushing a spade into the ground at the place intended for the berry plant and making a wedge-shaped opening by working the spade back and forth. The

roots of the plant are then spread out in fan shape and inserted into the wedge-shaped opening. Then the earth is drawn over the roots and tamped down firmly. Care must be exercised not to get strawberries set too deep or too shallow. The crown of the plant must come exactly at the soil line to be right.

CHAPTER V.

Pruning.

Need for Pruning.—Under modern conditions of fruit growing, pruning is just as necessary and inevitable as spraying. Trees that grow wild in the woods prune themselves. The strong branches crowd out the weak ones and slowly but surely the tree develops the form that nature intended it to assume. The fruit grower finds it imperative to hasten the pruning process instead of waiting for nature. Modern fruits are more subject to insect and fungous injury than are the wild fruits of the woods, and for that reason everything possible must be done to help withstand injurious assaults from insect pests. If a tree were left unpruned, it would soon become a thicket of branches and leaves, and as a result, light and air are shut out from the center of the tree. A dense growth of this sort is always favorable to the development of fungous diseases. Sunlight and air are great disease preventers, whether in relation to the human system or plant life. A man closed up in a damp house may well be compared to an unhealthy tree in matters pertaining to light and ventilation. We must realize then that pruning is needed to give the tree light and air.

Another reason for tree pruning is the need of building the size and shape of the tree. In the first place spraying is now considered one of the essentials of successful orchard work; and a tall, overgrown tree cannot be sprayed to advantage, so it is incumbent upon the grower to keep his trees headed low to facilitate this work. Apples from low growing trees are also much easier to harvest than those from tall, overgrown specimens. The modern tendency is to prune fruit trees

so that they will assume the form of a large bush rather than the tall form that was so common in the older orchards.

Pruning is also used to stimulate the tree or even check its growth. Winter pruning can stimulate a weak tree toward making a sturdier growth. A tree of strong growth that tends to produce wood at the expense of fruit can be made to form fruit buds by early summer pruning.

A thrifty young orchard.

Time to prune.—We are now ready for the question regarding the best time to prune. An old adage says that the time to prune is when your knife is sharp. While this saying is not accepted at its face value, still it contains much wisdom. If all pruners were particular to see that they used only sharp, clean tools, that work would be accomplished with much greater neatness and dispatch. Probably the best time to prune any kind of tree is just at the end of winter and before

the buds have started to open in the spring. By pruning at this time, when the trees are just ready to start a vigorous growth, the wounds made in pruning will heal over much more easily.

Stubs.—Regardless of the season at which the work is done, there are a few rules that must be kept in mind concerning this practice. In removing a branch from a tree care must be exerted to cut just as close to the body of the tree as possible. Never cut branches so as to leave stubs. They will not grow and simply die back to the main branch where, as they decay, they carry infection into the heart of the tree. Many orchards have been ruined by carelessness in this detail.

Large branches; Painting wounds.—When a large branch is to be cut off, it is best to make two cuts. The first cut should be made eighteen inches or two feet from the place at which the branch is to be removed. In this way the weight of the branch is eliminated and the stub can be sawed off without danger of splitting the bark on the underside. After large branches have been taken off, the wounds should be painted with something to prevent them from drying out and also to prohibit rot. If the orchard displays any evidences of blight, bitter rot, or black rot, all the large cuts should be washed with a disinfectant solution and permitted to dry before they are painted. It is especially important that all pruners keep this point in mind. The best disinfectant to use for this purpose is a one to one thousand solution of corrosive sublimate. This is deadly poison and the bottle containing it should be so labeled. This solution will kill the spores of any diseases that are liable to be carried from tree to tree on the pruning tools. Where small shears are used to work in diseased trees they should be dipped into the disinfectant before a new tree is touched. A few hours may be given for the cuts to dry after they have been washed with the disinfectant, and they should then be painted to protect the surface from further sources of infection. Orchardists have used various substances for this purpose, and the list of paints or "daubs" will include

everything from mud to grafting wax. Mud is about the poorest material and grafting wax about the best for this purpose. If grafting wax is used it should be handled hot enough to be

Two-year-old apple tree before and after pruning.

applied with a brush. However, excessive heat is to be avoided also. A wax can be made with linseed oil as one of the ingredients which resembles a thick, sticky paint. Such wax is, of course, not suitable for grafting. White lead and linseed oil

make a good tree paint, and there are several brands of prepared tree paint on the market. These legitimate paints must not be confused with the so-called "tree paint" sometimes sold by fakers who claim such wonderful results if trunks are painted with their mixture. Trunks of trees should never be painted with anything that ever remotely resembles paint under any circumstances.

The work of pruning begins early in a young orchard. In fact it begins as soon as the trees are planted.

Apple Pruning.—In the first place we will consider the pruning of the apple tree. If one-year-old trees have been planted, they will consist of a single "whip" from four to six feet in height. This whip should be cut back to a stub thirty inches in height. During the growing season this stub will throw out several branches which will be utilized in forming the permanent framework of the tree. At the beginning of the second year these new branches must be examined and three or four of the most vigorous selected to become permanent. All others are cut off. Those that are permitted to remain are then headed back much as the original tree was pruned the year preceding. It will be seen that the work of training each particular branch of this small tree is but a repetition of training the tree in the first place. If this first pruning is done intelligently and carefully it will reduce future work in this respect to a minimum.

If the planting consists of two-year-old trees, the first pruning will be, in general, the same as that given to a younger tree after it had grown for a year. A few sturdy branches are chosen to represent the permanent limbs of the tree and these are left after being cut back to a strong bud. It might appear that by planting two-year-old trees, the planter might gain a year's time. This supposition is not true, however, for the older tree never makes the same vigorous growth that is accomplished by a one-year-old tree. Of course there are occasional exceptions; but exceptions do not always make rules—they usually prove them. After the young tree is well started,

the pruning should average about the same each year. It will be necessary to keep the centers of the trees from becoming too thick, and no crossed branches should be permitted to remain. Different varieties often require separate attention, so suggestions for their treatment will be given at this point.

Pruning different varieties.—Since the Grimes Golden does not require so much light and air as most other varieties, it will need consequently less attention. A bright red apple

Before and after pruning a four-year-old apple tree. The tree was started as a "leader" tree, but at this pruning it was decided to change it to an open center tree. The pictures show how this was done

will never acquire its full color unless it has plenty of sunshine. As a result, red varieties should be so pruned that every apple on the tree will have its proper share of light. Some of the Russian varieties, like the Yellow Transparent, have a tendency to grow upright, much as a pear tree grows. Severe pruning sometimes fails to correct this inclination and accordingly this variety constitutes one of the severest trials of the fruit grower. The Winesap is by nature an open-headed tree. With but a little training it will cause less work in an orchard than any other sort; but if neglected, it has a habit of tying

knife in his branches. A long neglected Winesap is indeed one of the most trying trees imaginable to prune.

Pruning old trees.—The work of pruning any old neglected tree often presents very difficult problems. If the branches are thinned out enough, too much direct sunlight will result in the injury known as "sun scald." Sun scald is simply the sunburning and killing of bark that has grown too long in the shade. Old trees should have all dead wood and all water sprouts taken out. Water sprouts are the vigorous upright sprouts found on the trunk and large limbs of neglected trees. Next all crossed branches that seem to interfere with each other should be removed. Time and care should be taken to study the tree as it is shaped. It should always be borne in mind that the object of pruning is to enable that particular tree to bear the greatest number of perfect apples possible. Apples can not be perfect if grown in a tangle of brush. They must have air and sunlight. Good pruning of old trees is largely a matter of wise judgment and common sense. I have seen men prune ruthlessly who could scarcely tell an apple tree from a pear tree. These men were not backward in using their brains or in common a proposition as the best way to saw out a superfluous limb.

Pruning peaches is a much different proposition from the pruning of apples. The peach bears its fruit on wood of the previous season's growth. Consequently, in order to have an abundance of fruit-bearing wood each year, the peach tree must constantly be cut back so as to make it throw out a vigorous growth of new wood. In this instance the production of wood and fruit are synonymous. When the young tree is planted it is cut back to a stub from eight to eighteen inches in height. Authorities disagree as to the best height, but the author finds that height most advantageous. From this stub the new growth starts vigorously and the next season the tree must be thinned out so that only three or four sturdy shoots are left. These shoots are then cut back about the same way that the shoots on the young apple were cut back or practically

farther. During the second year the peach will grow to be quite a tree, and again the extra branches are removed and the remaining ones are cut back from one-half to two-thirds their original length. If this practice be neglected, the tree will soon be out of reach of the grower and all new wood will be produced so high above ground that a ladder will be needed to harvest the fruit. There should be but little use for ladders in the modern peach orchard if the trees are proprly pruned from the start. If they are not pruned right at first, there is no tree that will grow to more ungainly proportions. After the third year the peach tree should not be pruned so heavily. At about that time it may be expected to bear a few peaches, and if too much of the previous season's wood is removed, the fruit buds are also decreased in number.

The vigor of old peach trees may sometimes be renewed by heading them back to stubs. This process is called "dehorning," or, better, "deheading." All the upper part of the tree is taken off except the stubs of the main branches. Under favorable conditions these stubs will throw out strong shoots that will replace much of the fruit-bearing wood that was removed. This process may also be used on peach trees after they have been severely injured by a very cold winter. As a general rule it is a good policy to prune any peach tree severely that has had its fruit buds killed during the winter. At such time there is no sacrifice of fruit bearing wood because under those conditions no fruit buds exist. The heavy pruning will result in a vigorous growth that will reproduce most of the fruit bearing area that was re-

Severe heading back of a peach tree after a cold winter.

Ten-year-old apple tree in fair condition, showing the amount of wood removed in the course of a normal pruning.

moved and at the same time serve to bring the bearing portion of the tree nearer the ground and within easier reach.

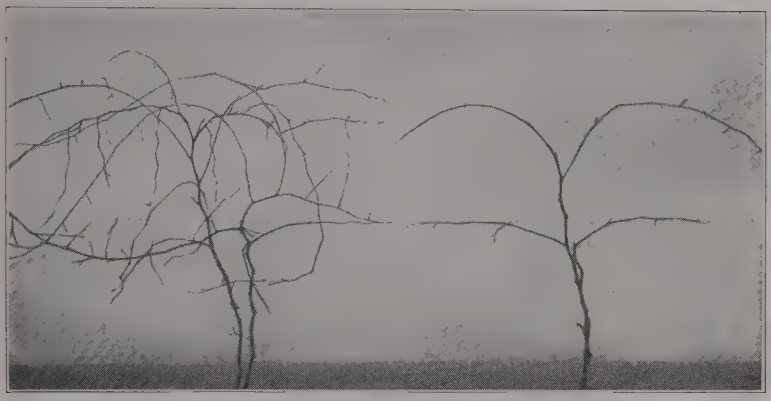
Plums and cherries differ from the peach in that they do do not require such severe pruning. Some growers never prune their cherry trees except to remove weak branches or to open the head of the tree slightly. The sweet cherries are quite a problem to the orchardist on account of the fact that they tend to grow in an upright form with a main stem. It is difficult, if not impossible, to change this habit of the sweet cherry tree, and, as a result, the growers of this class of fruit simply make the best of circumstances. Sour cherries naturally form a low, open top and require practically no pruning. Plums are sometimes seriously injured by too much pruning. A few varieties of Japanese plums seem to be moderately benefited by pruning, but in no case should it be as severe as that outlined for peaches.

Pears should not be pruned at all, if the greatest protection from blight is desired. Blight is a disease that seems to attack the more tender growth, and, as pruning tends to stimulate growth, such work should be avoided. Sometimes it is necessary to remove a few branches to improve the shape of the tree; but, aside from this, the general pruning of the pear should be avoided.

The pruning of grapes is an art in itself. There are many systems in vogue and each grower thinks his method best. As a matter of fact, many systems have given admirable results and it is a choice of which system is better suited to a given district. In this text space can be devoted to only one of the many different methods of grape training and this particular form is known as the "Knifin" system. There are even variations of the Knifin system, but the general idea is the same.

When grapes are planted, from one-third to one-half the roots are cut away. This is perhaps the first pruning to which the vines are subjected. After planting, the vines are cut back to one or two buds. The vines are permitted to grow the first year without supports. At the end of the first season they are

again cut back to the ground and during the second summer they should be induced to form only one or two upright canes. When these canes have reached a height of four to six feet they should be cut back and made to throw out side branches. Wires are then stretched on posts at a height of from four to six feet from the ground. If two canes have been allowed to develop, one of them should be tied with its lateral branches to the top wire and the other to the lower wire. The vines should be ready to fruit during the third year. In the case of



Illustrating the Knifin system of grape training. The same vine pruned and unpruned.

grapes the fruit is borne on shoots which grow from buds located on the previous year's growth. This is always an important point to remember in this connection. The lateral branches that are tied to the wires will throw out numerous shoots on which the grapes will be produced. The shoot nearest the main cane should not be permitted to bear any grapes, for it is reserved for next season's crop. At the end of the season all the fruiting portion of the vine is cut off with the exception of the shoot that was not permitted to bear. This shoot is bent upward and tied to the wire. It is then headed back for a distance of from one-third to one-half its length. This cane

then becomes the renewal branch for the crop of the succeeding year. The accompanying photograph taken in a large commercial vineyard illustrates this entire process perfectly.

The pruning of small fruits will be taken up in the chapter devoted to them.

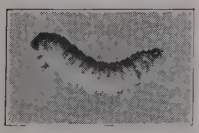
CHAPTER VI.

Injurious Insects.

All injurious insects of the farm may be roughly divided into two classes known as the chewing insects and the sucking insects. Chewing insects secure their food by eating the tissue on which they feed, while the sucking insects insert their mouth parts into the plant tissues and withdraw the juices.

Sucking and chewing insects.—It will thus easily be seen that the two classes of insects must be controlled in entirely different ways. It would be useless to try to kill plant lice, which are sucking insects, by applying to the trees or plants any poison such as Paris Green. Paris Green is an "internal" poison and must be taken into the system with the food, if it is to kill the pest in question. Since it is impossible to inject the Paris Green into the juices of the plant, it is self-evident that the plant louse would not have access to any of the poison, and might continue to feast on a sprayed plant with entire impunity. Consequently, Paris Green, arsenate of lead, and similar insecticides are used only for those insects that actually eat the tissues of the plant. For the sucking insects sprays must be used that will kill as they come in contact with the insects. This latter class of sprays is called "contact insecticides."

Codling moth.—Probably the best known orchard insect in America is the codling moth. It is found wherever apples are grown. No section is free from its ravages and each year it does thousands of dollars worth of damage in every state in the Union. This insect may be taken as a type for its entire class and a brief outline of its life history will serve as an example of the many chewing insects. The adult (mature) codling moth is a small, brownish winged insect about three-quarters



Larva of codling moth.

of an inch in length. The female lays her eggs on or near the young apples and as soon as the eggs hatch, the tiny worm (larva) eats its way into the fruit and remains there until it attains its full growth. The full grown larva then emerges from the apple and spins for itself a small cocoon under a scale of bark or in some other well protected place. Within the cocoon the larva changes into still another form called the "pupa." In the case of butterflies the pupa is called a chrysalis. The insect remains in the pupa form, which is purely a resting stage, for various periods of time according to the species of insect. In every case, however, the pupa eventually transforms into the adult or mature insect.

Adult codling moth (enlarged 4 times).

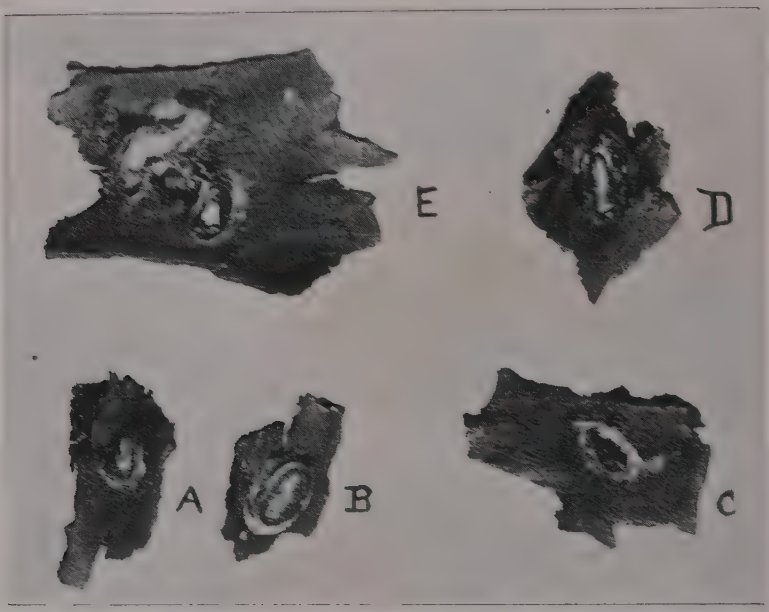
For the most part, chewing insects do their greatest damage while they are in the larval state, because it is during that period that they make their greatest growth. Very often the adults do not feed at all and in some cases only to a very small extent. These changes which the insect experiences from the time it hatches from the egg until it assumes adult form are called the life cycle.

Codling Moth control.—The codling moth lives over the winter in the pupa stage and early in spring the adult appears in orchards. The eggs are laid as above indicated at about the time that the trees come into bloom. It is the problem of the orchardist to poison the young worms before they can get inside of the fruit. This is accomplished by spraying the trees soon after they bloom, with a solution of arsenate of lead. Most of the young moths enter the fruit at the blossom end and one of the objects of spraying is to fill the blossom or calyx end of the fruit with poison. If the spraying is properly done, practically all the worms will be killed before having an oppor-

The second brood of codling moth, showing entrance hole at the side of apple and the eggs on the calyx end.

tunity to damage any fruit. Actual experiments have shown that it is possible to prevent over 98 per cent. of the injury caused by this insect. If neglected it is one of the most destructive insects known: but with a little careful work it is easily controlled.

Second brood.—The codling moth has a second brood ar-



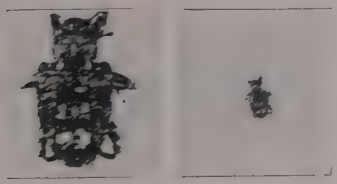
Flakes of bark from an aple tree showing cocoons of the codling moth on the underside. A and B—Cocoons unopened. C—Cocoon containing a pupa. D—Cocoon containing an as yet untransformed larva. E—Shows a small hole through the flake of bark. Through this hole one of the smaller winter woodpeckers has extracted the insect.

riving the last of June or early in July. This second brood consists of individuals that were not killed by the poison or that developed in some nearby neglected orchard. If all orchards were thoroughly sprayed, the second brood would be insignificant in numbers. Some orchardists are not as careful as they should be, however, and as a result even the careful grow-

ers must spray for the second brood. It is the adults of this second brood that winter over and deposit their eggs the following spring.

The lesser apple worm is often mistaken for the codling moth. It bears a striking resemblance to the latter, but appears much later in the season and can always be recognized by its peculiar method of injuring the fruit. The codling moth makes its way directly to the core of the fruit. The lesser apple worm makes a tortuous mine or tunnel under the skin of the fruit. The lesser apple worm is a very destructive pest in stored fruit for the reason that it will migrate from one apple to another. In this way one wormy apple may be the cause of injury to several apples in the same barrel. Since the eggs are laid late in the season, it is often hard to see any signs of the insect when the fruit is gathered. The only remedy is to spray with arsenate of lead later in the summer than is usually done for the codling moth, and by all means to do a thorough job of spraying.

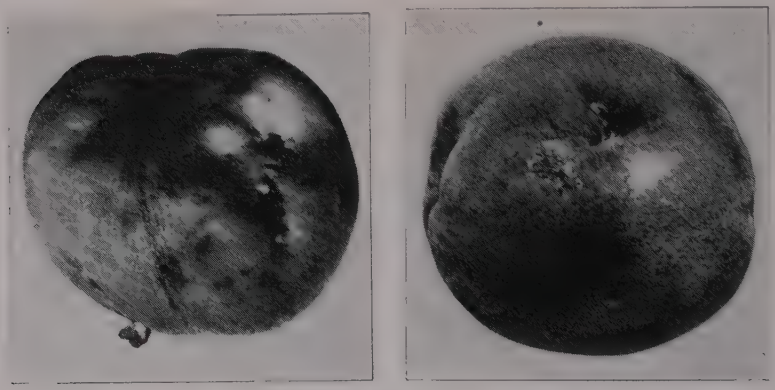
The plum curculio is perhaps the most destructive of all insects affecting fruit. While its name might lead one to believe that it damaged only plums, it is also found destructive to peaches, cherries and apples and occasionally other fruits as well. The adult insect is a small beetle that appears in the very early spring and lays its eggs in crescent shaped slits which it makes in the fruit. The eggs are deposited within the flesh of the fruit, so that poisoning with any of the ordinary sprays is impossible. In a few cases growers have devised a means of collecting the insects from the trees by placing canvas under the trees and then jarring them. The beetles fall into the canvas, where they are readily gathered up and destroyed. This method is not entirely effective and so expensive as to be pro-



Plum curculio (natural size and enlarged).

hibitory to the average grower. The most progressive orchardists are now controlling the curculio by spraying the trees very early in the spring, just as soon as the first leaves open. A strong solution of arsenate of lead is used. This spray, which is intended to kill the adult insects before they have an opportunity to lay their eggs, is found very effective.

The peach borer is the name given to an insect that bores into the base of the trunk of the peach tree. The borer is the

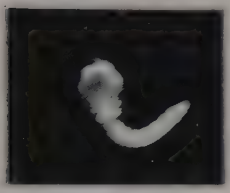


Work of the curculio on peach.

larva of a small moth. The adults emerge about the first of June and from that time until September mature individuals may be found. They probably lay eggs all summer long. In the fall the larvae are to be found in all stages from very small "worms" to nearly full grown borers an inch or more in length. All sorts of plans have been devised to control this pest; but, from the standpoint of the practical fruit grower, there is only one method of control that is practical. This consists of simply digging the borers out with a sharp knife. They sometimes extend into the roots of the tree and the soil must be removed from about the trunk to a depth of five or six inches. This method may injure the tree more or less, but

not nearly as much as the borers would if they were unmolested.

The flat headed apple borer is the larva of a beetle about an inch in length. These beetles are widely distributed and probably injure many kinds of trees. It is certain that they sometimes appear in isolated orchards that have been newly planted in cleared spots in the woods. As a rule, this borer will not attack a tree unless it has been previously weakened from some other cause. They are seemingly on the lookout for trees that have been reduced in vitality for other reasons, and, when they once attack a young tree, they usually make short work of it. There is no known remedy except to keep the trees in a state of good health, and if they should be attacked the borers should be cut out. Of course if the tree is badly damaged it must be replaced.



The flat-headed apple borer

The imported currant worm is the most common of the insects injurious to currants and gooseberries. The larva is about three-quarters of an inch in length and a pale green in color. Like all leaf eaters, it may be controlled by the use of arsenate of lead. If the fruit has started to ripen, powdered hellebore should be substituted for the arsenate. It is not quite so effective, but there is less danger of poisoning the persons who use the fruit.

The grape berry moth is the most serious insect enemy of the fruit of the grape. It causes the common injury known as wormy grapes, that are to be found in most places where the vine is grown. The insect passes the winter in its cocoon attached to dead leaves on the ground. Cleaning up the vineyard will do much to keep this pest in check, but thorough and frequent spraying must be practiced in badly infested vineyards. The arsenate of lead may be combined with Bordeaux mixture and the spray made effective for both the grape berry moth

it.

Grapes that have been sacked are usually free from insect injuries and dirt.

and for several fungous diseases. In small vineyards and in home grape arbors the fruit can be easily protected by tying a paper bag over the bunches. This should be done soon after the grapes bloom and before there is any sign of injury on them.

Canker worms are sometimes very injurious to apple orchards. The larva is a brownish measuring worm and the injury consists of eaten foliage. Entire orchards may be defoliated by this pest, but the ordinary spray as for the codling moth will usually prevent any serious damage.

The so-called bud moth is one of the insects that has recently attracted the attention of fruit growers and each year it becomes more common. The larva of this moth is a brown caterpillar with a black head and measures about half an inch in length. The caterpillars winter over in small nests and in early spring they emerge and eat into the opening buds. An application of arsenate of lead just as the buds are opening will usually control the bud moth satisfactorily.

The yellow necked caterpillar is easily recognized by the fact that there is a band of bright yellow just back of the head. It is a large worm, measuring nearly two inches in length, and feeds in colonies. In young orchards these colonies can be easily seen and the worms killed. In older orchards that are regularly sprayed most of the pests will be controlled incidentally.

The tent caterpillar builds a nest in the forks of small branches on many kinds of fruit trees. The worms are about one and a half inches in length, blue black in color, thinly covered with yellowish hairs and marked by a white stripe down the back. Their nests may be burnt out or arsenate of lead may be sprayed on the surrounding foliage where they feed. The fall web worm is similar in all respects to the tent caterpillar except that it occurs in the fall, while the tent caterpillar is found only in the spring.

The pear slug is a slimy, soft bodied larva which attacks

The pear slug and its work.

the foliage of pear, plum and cherry. It usually eats only the upper surface of the leaf, leaving the skeleton of the veins. Arsenate of lead will control it: but, owing to the fact that the body of the insect is sticky, it may be more easily destroyed by dusting the trees lightly with powdered lime. Place the lime in a burlap bag, tie the bag to a pole and shake over the trees. The lime sticks to the body of the larva and quickly kills it. I have known fruit growers to get the same results from a handful of road dust sprinkled over the insects. A little watchfulness early in the season will save much damage later.

The fruit tree bark beetle is a small insect that bores holes in the trunk and branches of most any fruit tree. It has been claimed that this insect will never attack a healthy tree, but prefers to work on some other tree that has been previously damaged by another agency. This is probably true, although trees are sometimes found infested with this form which appear to be perfectly healthy in every other way. At any rate, when the beetles once get started there is no cure for the trouble. The tree should be cut and burned at once.

The blue flea beetle is one of the commonest pests in the vineyard. It winters over in leaves and rubbish on the ground and comes out in very early spring to feed on the new shoots of the vine. In a few days it may entirely destroy all prospects for the year's crops. Clean cultivation in the vineyard and early spraying with arsenate of lead are the only means of keeping this beetle in check.

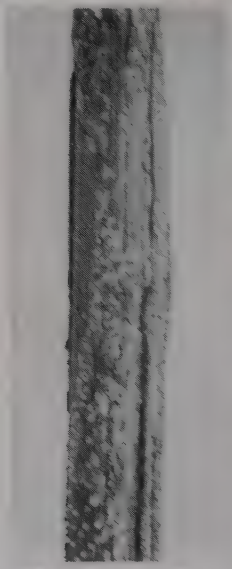
White grub worms, the larvae of the common brown "June beetles," are frequently injurious in strawberry fields. They are more common in land that was previously in sod, and for that reason it is unwise to plant strawberries in sod land. If the sod can be pastured to hogs for a few months in the fall, they will usually clean out most of the grubs. The use of tobacco stems will also make the soil distasteful to them, and it has been suggested that strawberries be mulched with these stems instead of straw. The cost will be somewhat more, but if injury can be prevented, the extra expense may be justified.

Sucking insects.—The second great group of insects that are to be considered are those which obtain their food by sucking the juices from the plant. As has been mentioned before, these insects can not be killed except by the use of some spray material which will kill when it comes in contact with their bodies. These are called contact insecticides. The sucking insects include many of the worst pests with which the orchardist has to deal. All the scale insects and the plant lice are true sucking insects.

The scale insects are so named, because when they attach themselves to a tree or plant, they secrete a plate or scale which completely covers their bodies and affords them much protection. It is this scale which makes the insects difficult to control, for any insecticide must first penetrate through or under the protective covering before it can come in contact with the body of the insect itself.

The San José scale (pronounced San Hosay) is easily the worst and most widely distributed of our scale insects. It was imported on nursery stock from China many years ago and has

since been distributed generally over the country by careless nurserymen. The insect itself is a small sulphur-yellow creature, but is covered from sight by the circular scale plate. The young scales are not hatched from eggs, but are born alive and immediately begin to crawl about in search of a place to which to attach themselves. This continues for about twenty-four hours, when the insect attaches itself to a portion of the bark and inserts its beak into the living tissue. Very soon afterward the secretion of the scale covering begins and this scale covering increases in size as the young insect grows. Under the magnifying glass the individual scales appear to be perfectly round and with concentric rings extending from the outside to the center. The center is slightly raised or pointed. The first young are produced with the first warm weather in spring, and they continue to multiply all summer. A few scales on a tree in the spring may be the means of completely covering it before fall. The accompanying picture shows a portion of bark from an apple tree that is crusted over with the San José scale. In the picture they are magnified about ten times or about as they would be enlarged with a strong hand magnifying glass. At one time it was feared that this scale would destroy all the orchards in this country. After a vast number of them were forfeited, experimenters found that the pest could be kept in check by the use of a spray made from lime and sulphur. This material is very caustic and will injure the foliage, if applied during the summer; so that work toward exterminating the San José and other scale insects must be confined to the winter season.



The grape scale.

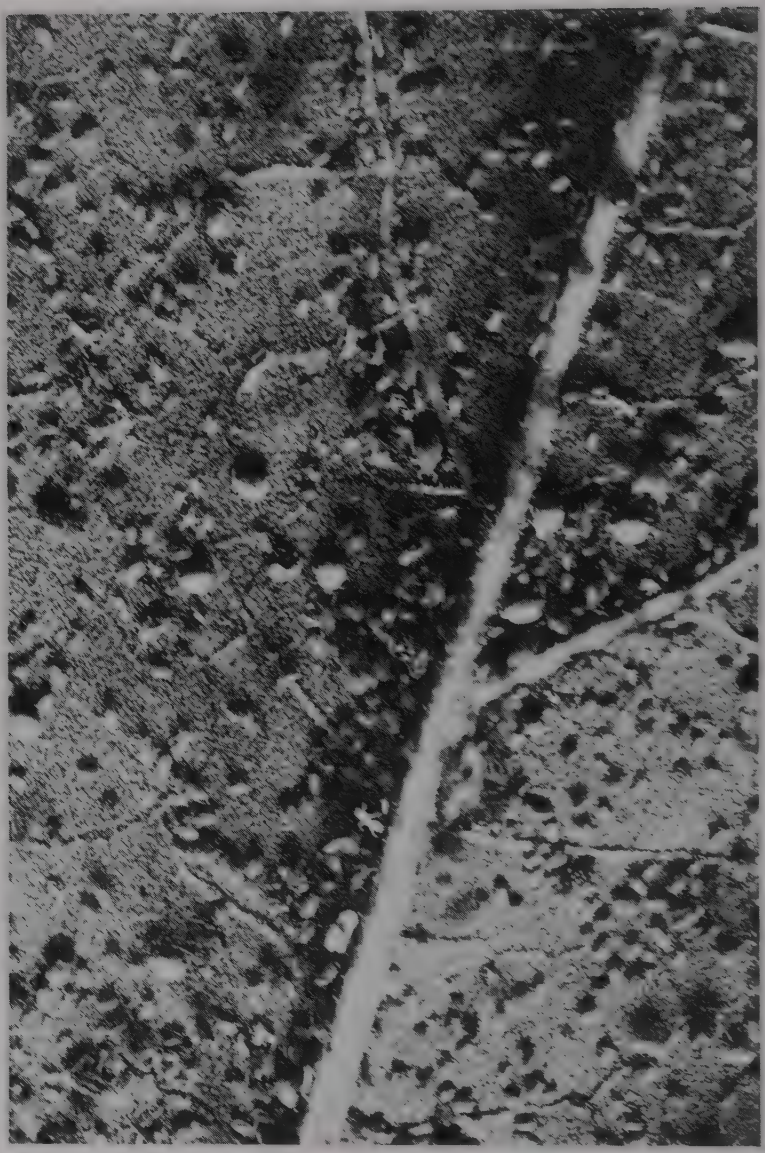
Grape Scale.—Some times grape vines, especially in cities, are infested

with a scale insect that closely resembles the San Jose scale. This is the grape scale, and it is to be found only on these vines. On the other hand, San Jose scale seldom attacks the grape. This insect on the vines is particularly difficult to control because of the fact that it works its way under the thin, scaley bark and is protected from any spray solution that may be applied. However, the lime sulphur solution will kill it, but it must be applied thoroughly and with a good deal of pressure so as to penetrate all of the irregularities of the vine.

Spraying to control scale insects.—In spraying for the control of any scale insect the fact that these insects can be killed only by the contact of the spray dope with their bodies must be kept constantly in mind. Every portion of the tree must be completely covered with the mixture. Remember that these scale insects are firmly attached to the bark, and, even if they were not, they would probably not be so obliging as to crawl about and wallow in the insecticide. It is the business of the man doing the spraying to be sure that every portion of the tree is absolutely covered.

The Scurfy scale is a whitish scale much larger than the San José. It is to be found in nearly all apple orchards, but seldom does much damage. The scale insect lays eggs in the fall of the year and these eggs are protected by the same scale plate which formerly covered the old female scale. The eggs are somewhat more difficult to kill than are the insects under the scale plates of the San José. Whenever this scurfy scale does become a serious pest, it is often more difficult to kill than is its Chinese relative.

The oyster shell scale is a common form which is sometimes serious in nurseries and orchards. It is also to be found in the woods, as it is a native scale. I have found it as far north as Canada, growing on some of the shrubby dogwoods. It is fully illustrated in the accompanying cuts. Like the scurfy scale, this insect lives over winter in the egg state and is quite difficult to control. One of the most effective means



Typical plant lice. The large, rounded ones were brown in color and were inhabited by parasites.

Work of the Apple Leaf-miner

in the opening buds where they begin to feed. The caterpillar

of caterpillars is to be seen the tiny white white cocoons of small ichneumon flies as the young grubs have emerged in the spring. At this time they are very easily killed.

Plant lice.—There are many forms of plant lice, all of which are slightly injurious to the plants on which they feed. They are small, soft-bodied insects which obtain their food by sucking the juices from the more tender parts of the plant. The plant lice are called "aphids" (singular, aphid).

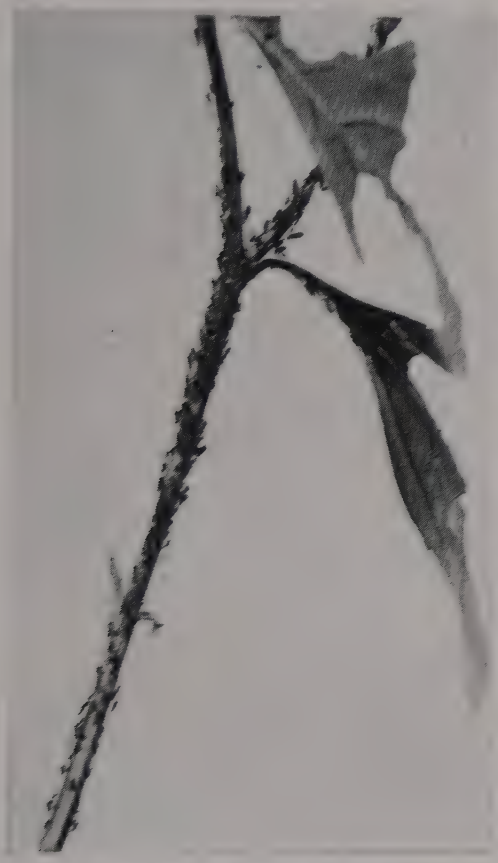
Green apple aphis.—One of the commonest and most injurious of the plant lice is the green apple aphis. It is green in color and lives on the under side of apple leaves and on the stems and leaf stalks. It is usually found on the tender, growing tips of the branches and after it has been at work on a branch for a short time, it causes the leaves to curl under from the edges. In this way the insect is greatly protected against any spray material that might be used. It winters over in the egg form. The eggs may be found during the winter on the younger branches. They appear as very small, glossy black objects often scattered together in some numbers. These eggs hatch early in spring and the young aphids crawl

should always be on the lookout for these eggs while he is pruning the trees in the winter. By being watchful, he can tell which trees are infested. If no eggs are found, no control measures are of course necessary, but if eggs are present, the trees should be sprayed with either a strong lime sulphur solution, such as is used for the San José scale, or with a tobacco solution soon after the buds open. If this work is neglected until after the lice have had a chance to curl the leaves any control measure will naturally be less effective than if the pest were given prompt attention.

The rosy apple aphis differs from the green form in habits as well as in color. It is supposed to spend part of its life on some other plant; but up to the present time entomologists have not discovered what this plant is. At any rate the insect does not appear on the apple until some time in the early spring and leaves the tree after a few weeks. As a rule it is not so injurious as the green louse, because it does not remain on the tree during the entire season. Both this and the former insect feed on clusters of small fruit and cause them to become permanently dwarfed. Apples injured in this way will never develop into marketable fruit and should always be removed and destroyed.

Early infestation by plant lice produce these clusters of dwarf apples.

The black peach aphis feeds on the roots of peach trees and at certain seasons it ascends to the top of the tree and feeds on the branches. It is during the period spent on the branches that it breeds and spreads to other trees. It is easily controlled by spraying with a tobacco solution and the root form may be eradicated by the use of ground tobacco stems worked well into the soil. If this is done in dry weather, the first rain will wash the extracted poisons into the ground where they will kill the insects.



The woolly aphis is another form that lives on both the tops and the roots of trees. It is most commonly associated with the apple. On the roots this louse will form small knots or galls and around these will usually be found the white woolly covering of the lice. The insect itself is of a dark color, but is so completely covered with the white "wool" that it has the appearance of being a white insect. This pest is often sent out on young trees from the nursery. The planter should exercise great care in examining all trees before planting to be sure that none of the

unwelcome aphids are present. If, however, they once become established in an orchard very little can be done to exterminate them. They can not be readily killed in the ground, and the best thing the grower can do is to keep the trees otherwise healthy and to try to force them into a vigorous growth in spite of the woolly aphis. The insects as they appear above ground, on the branches, can be killed by the use of tobacco solutions.

The phylloxera is one of the very small aphids that attack the grape. It is a native American insect and does not do any great damage to our native varieties of grapes. European varieties are badly injured by it. The first vineyards of European grapes that were planted in this country were all killed by this pest. Then it was sent across the ocean to become established in France, where it threatened to wipe out the grape industry in that country. At last growers adopted the expedient of grafting the European varieties to American stocks, and in this way the pest was outwitted. Since all grapes grown in the Eastern states are of practically pure American strain, the damage done by the phylloxera does not count for much. Some varieties that have been produced by crossing American and European sorts are badly injured. The most serious work of the phylloxera is on the roots, but infested plants may usually be detected by the presence of small and inconspicuous galls on the leaves. The leaf form does not do much harm and is even sometimes found on American sorts. The insect itself is so small as to require a strong glass for its examination.

The grape leaf hopper is an insect that differs from both the scale insects and the plant lice. It secures its food in the same manner, however, and has been a most difficult form to control. It is an unusually pretty insect that by feeding on the leaves of the grape causes them to turn brown. They are extremely nervous and when a vine so infested is shaken, the hoppers will leap off in large numbers. These insects are very hardy and it requires a vigorous contact insecticide to exter-

minate them. This has been the main difficulty, in fact, connected with the control of this species. Any insecticide that would kill the pest would also kill the vines. One of the most approved and by far the most practical method is to spray the grapevines with a solution of Bordeaux mixture. This spray should be directed in such a way as to dislodge the hoppers from the vines, knocking them to the ground. Another spray machine should follow close behind the first and spray the ground with a coal oil emulsion or other strong insecticide, killing them before they can get back to the vines.

There are many other insects to be encountered in orchard work, but lack of space will not permit a description of them all. There are none, however, that will not fall naturally into one of the groups here mentioned; and, if the student masters the different forms and learns to recognize them as well as to prevent them from doing injury, he should have no difficulty in providing adequate treatment for any other insect that may come to his attention.

Not all insects are injurious. Some are beneficial in that they get their living by eating other insects. Those forms which prey upon others are called parasites and they do a most useful work in the world. If it was not for the parasites among the insects it would not be possible for human beings to exist, for the injurious forms would quickly overrun everything and destroy every vestige of vegetation. Consequently it is wise for us to know and to protect those forms that we know to be beneficial.

Lady Birds.—Nearly all lady bird beetles are parasites on other insects. These are usually small, bright-colored beetles, more or less round in shape and having a rather characteristic tortoise effect. One of the best known of these is the "twice stabbed lady bug," a beautiful little insect, coal black in color and having on each of its wing covers a bright red spot. This form feeds on the scale insects and it has been known to keep the San Jose scale in check. Other lady birds feed on plant lice and are largely instrumental in preventing very serious injury from these destructive forms.

The golden-eyed lace-winged fly is another curious and interesting parasite of the plant lice. The adult of this insect is a gauzy winged flying creature with bright golden eyes. The eggs are among the most curious structures to be found in the insect world. They are white in color and are attached

Eggs of the lace-winged fly.

Plant louse attacking a young [illegible] to which the eggs of the lace-winged fly [illegible] are attached.

to leaves, twigs or grass by means of a slender stalk several times longer than is the egg itself. The larva of this insect is often called the "aphis lion" because it is so savage in its attack upon the plant lice.

Blister Beetles.—Some of the blister beetles are parasitic and so much to help to check the various grasshoppers. However, most of these same blister beetles are also very active

at some stage in their life history and it is sometimes difficult to decide whether they do more harm or good. One form in particular feeds upon the opening flowers of fruit trees and it has been known to appear in such numbers as to strip every bloom from an orchard. They are particularly injurious to plums. The orchardist must decide for himself whether or not such a form as this is doing enough damage to warrant control measures. If the blister beetles are doing serious damage, then the trees should be promptly sprayed with a mixture of arsenate of lead at the rate of four pounds to fifty gallons of water.

Other parasites.—There are innumerable small flies that prey upon insects, most of them so small that they will often be overlooked. One of these lays its eggs in the skin of the common green tomato worm. The larva lives inside the body of the worm and eventually emerges and spins a white cocoon on the outside of the worm. Often tomato worms may be found that are simply covered with these cocoons and some people have had the fanciful notion that they were the "eggs" of the worm and attempted to destroy them. Nothing could be more foolish, as these white cocoons will each produce a single small fly, which, in its turn, will attack hundreds of other worms.

Most of these flies are so small and inconspicuous, however, that they will readily be overlooked, so they can take care of themselves. Very few parasites are destroyed through the ordinary processes of spraying.

One of the most interesting cases of insect control by parasites that I ever saw was in a large nursery where cherry trees were being grown in great numbers. The one-year-old trees were loaded with the black cherry aphis. These were confined to the tips of the branches. There were quite a lot of lady bird beetles feeding on the aphids, but not enough to get all of them. The nurseryman started a gang of men out, each with a bucket of oil emulsion. Each tree had to be treated and before dipping the infested tops into the insecticide the workman would shake the trees slightly to dislodge the beetles. The tips of

the branches were then submerged in the emulsion and the lice killed. This work was not quite finished by Saturday night and the nurseryman had scruples against asking his men to continue the work on the Sabbath. Accordingly the block of infested trees was allowed to stand untouched until Monday morning.

When the workmen started out the first of the week they were surprised to find that there was not a single live aphis left on the trees, where Saturday night they had been abundant. Since much of this infested block had been gone over with the insecticide and at the same time the lady birds had been saved by being shaken to the ground, it followed that the proportion of parasitic insects had materially increased. All day Sunday these little beetles, not knowing it was Sunday doubtless, had concentrated on the untreated corner of the block and had made a grand finish of the lice that were sapping the vitality of the trees.

CHAPTER VII.

Plant Diseases.

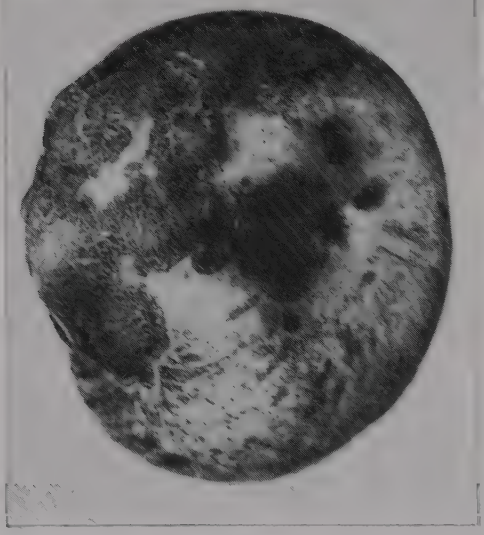
Cause of disease.—The San José scale is often mentioned by the uninformed as a disease. It is not a disease any more than the flea on a dog are a disease. In either case the condition is called an infestation. A plant disease is a sickness or disorder of the plant caused by the action of some bacteria or fungus which is growing on or in the plant. In this regard that condition in human beings and lower animals which is instantly recognized as a diseased condition has its resemblance in plants. In addition, plants also have diseases of which the cause is as yet unknown. One general term covers all of these as well as our ignorance of them. They are called "physiological diseases." The peach yellows, which has puzzled scientists for years, is in this class.

Bacteria and fungi.—It may be well to secure some idea of the nature of bacteria and fungi before proceeding to consider the various diseases which they cause. Both bacteria and fungi are very low forms of plant life and in most cases they are almost microscopic in size. Bacteria are always microscopic. Fungi are frequently large enough to be seen and easily handled.

Bacteria are one-celled organisms which possess remarkable powers of increase. A single bacterium may, in the space of a few hours and under the proper conditions of growth, give rise to thousands like it. Bacteria multiply either by simple division, i. e., pulling apart of the minute cell plant, or by the

formation of spores within the cell. In the latter case each spore is capable of developing into a bacterium. This process of spore formation is common whenever the conditions for the growth of the bacteria become impoverished. The spore is resistant to adverse conditions and will endure more heat, more cold, and any general abuse than will the active bacteria.

Fungi.—In order to obtain a good idea of what the plant body of some common fungi looks like and of the way in which it grows, a piece of stale bread should be moistened slightly, placed under a cover, and kept in a warm place for a few days. A white mold will be seen to form over the bread, and, if close examination is made, this mold will seem to penetrate into the bread mass. In due time tiny black specks will appear on the surface of the mold. If these are closely examined, they will be found to consist of a small black ball surmounting a stiff, straight stalk growing up from the mass of white threads. The white threads are called the "mycelium" of the fungus; and the little black specks are the cases in which the plant produces the spores. The spores themselves are microscopic in size, but serve the purpose of seeds. A microscope should be used to examine the fruiting bodies and their contents of spores.



Apple scab.

Apple scab.—Of all apple diseases the one known as apple scab is probably most widely distributed. It is to be found in every

place that apples are neglected. It is essentially a disease of neglect and, like tuberculosis, can be easily prevented. In fact most of the control work with plant diseases is work of prevention rather than of cure. The apple scab fungus lives over the winter in the dead leaves on the ground. With the first warm weather in the spring this fungus begins to develop. The fungus in the leaves starts to grow and soon develops fruiting bodies containing countless spores. These spores are carried in the wind and deposited all over the trees. As soon as the young fruit is formed, as soon even as the young leaves begin to peep out of the buds, the apple scab fungus is awaiting them. It will attack the fruit, the leaf, and the young branch, although its injury to the latter is of minor importance. The characteristic appearance of scab on mature fruit is well shown in the accompanying cut and no especial description is needed. This affliction can be controlled by an application of dilute lime sulphur just before the flower buds open and another after the petals fall, using the same material.

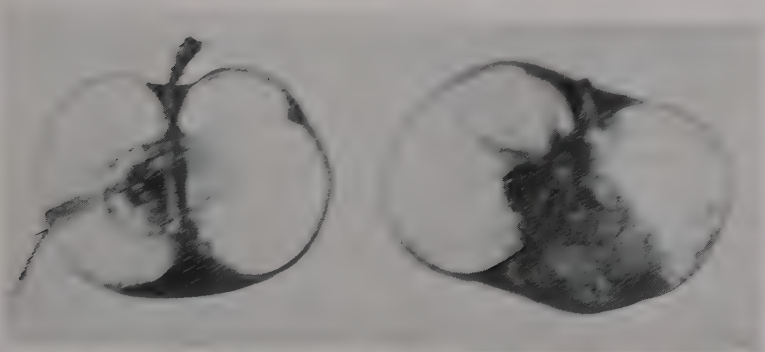
Apple scab as it appears on the leaf

Bitter rot is another disease of the apple that is more common in the southern districts. It is more difficult to conquer than scab, but appears later in the year. The fungus that causes this disturbance lives from year to year in large, rough cankers on the large branches of the tree. Each summer a crop of spores is produced and

A canker on a small limb of apple

sprinkled downward through the tree, falling on the fruit which hangs below. Wherever these spores fall on an apple, they may develop the rot which is so characteristic of the disease. The rotten area is brown in color and it spreads from the surface towards the core just as fast as it spreads on the surface. This will usually serve to distinguish it from black rot. The dilute lime sulphur solution will not control bitter rot. Bordeaux mixture applied at intervals, starting about five or six weeks after the petals fall, is the common procedure. If the diseased areas on the branches are also cut out and painted with melted grafting wax, the disease will be still more easily kept in check.

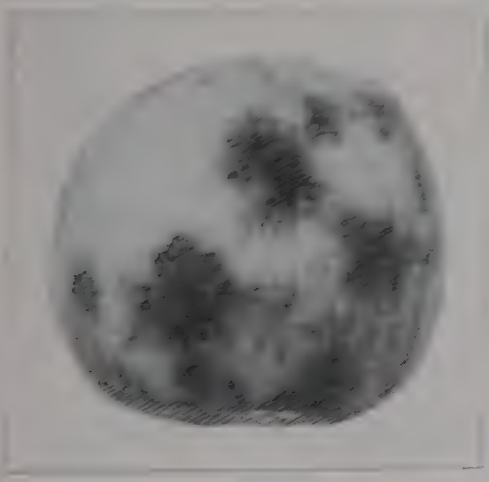
Black rot resembles bitter rot, but it is not such an important fruit disease, as it is a leaf disease. The fungus causes leaf cankers that are difficult to distinguish from the cankers of bitter rot and these cankers furnish the infection for the leaves. The diseased leaves usually fall about the middle of the summer and in this way cut off much of the food supply from the tree during the fall months. This nourishment obtained in the fall is most essential for the fruit crop of the ensuing year. Thus the effect will be secondary, but is a



[illegible]

serious damage nevertheless. The usual sprays as for apple scab will generally control black rot, but in addition to that precaution all branch cankers should be carefully removed.

Fruit is a source of the loss of the apple that has attracted much attention in recent years and has apparently not received nearly enough to warrant any amount of research. It is another instance that has been gradually making its way northward, which will have ever to be used vigorously where cankers on the twigs and small branches. These cankers disseminate spores about the middle of June, but after this time small brownish pustules may be found on the fruit. The disease on the fruit is superficial as it does not extend far below the skin. In the autumn the fruit



[illegible]

vidual blotches appear as if they might have been caused by some light brown liquid splashed on the skin. As the disease progresses these blotches become hard and much darker in color. Eventually they crack open and the fruit is ruined. The first method of control used on blotch consisted of repeated sprays applied every two weeks after about the middle of June. Bordeaux mixture was preferred to the dilute lime sulphur for this purpose. Recently it has been found that the disease can be absolutely controlled by spraying the trees in winter with a solution of commercial lime sulphur diluted at the rate of one part lime sulphur to five parts of water. This spray also controls scale insects.

One characteristic of apple blotch is its aptitude for attacking certain varieties and avoiding others. Almost all greenish or yellow apples, except possibly Grimes, are more subject to blotch than are the completely red apple. A very few red apples are injured by this malady, however, and the following varieties, none of which are first rank commercially, are much more subject to this disease than others: Northwestern Greening, Mann, Smith Cider, Stark, Missouri Pippin, Ben Davis.

Sooty blotch and fly speck are two minor fungous affections that sometimes attack apples. The name of each describes its appearance fully. In the former, evidence of disease appears like a small dab of soot spread evenly over the fruit. The fly speck looks exactly like what its name implies. They are both controlled in regularly sprayed orchards.

Blight is a bacterial disease that affects both the apple and the pear. It is so much more common on the pear that common usage has given it the popular name of pear blight. The disease is identical whether it happens to be on either the apple or the pear. This disease lives through the winter in the infected twigs and branches and in the spring these infected parts exude a sticky substance that is filled with the organism that causes the disease. Insects, including the honey bee, visit this sticky exudate and carry away a supply of spores on their

spores. They are carried about over the blossoms and twigs of the apple and pear. They start the trouble in some such way. Probably if the honey bee were to be exterminated, the spread of blight would be greatly checked; but the bee is so necessary in carrying pollen from one flower to another that

A pear tree in flower. Compare with the next.

no good fruit grower would ever dream of it. In that case we are obliged to have the bees in the orchard and so must risk having them carry the germs of the deadly blight with them. There is no cure for blight. Diseased branches can be cut off and burned, but must be taken off much below the place

giving evidence of affection. Be sure to cut down into the clean, healthy wood or the malady will simply follow the stem and eventually kill the entire tree. There can be no mistaking a tree or branch that has been killed by blight. From no other cause do the leaves turn black and remain on the tree. In pruning a blighted tree, the contagious nature of the disease must be constantly kept in mind. Always disinfect the pruners with a solution of corrosive sublimate made by dissolving one part of the chemical in one thousand parts water. This solution will kill the germs of the disease, but it is highly poisonous and must be handled accordingly. After pruning, wash the wounds with the same solution and when they are dry, paint them with a good lead paint or with melted grafting wax.

Blight seems to occur in different forms at different times. Sometimes an attack will be very severe; and at another it will result in killing a few twigs. In this respect there is a resemblance to certain bacterial diseases that attack the human family. In some years the epidemic of grip is very sweeping, while in other seasons the disease will seem more like a severe cold. Sometimes blight will attack only the twigs and again only the trunks and large branches. Sometimes it attacks the trunk near the surface of the ground and kills a ring of bark around the tree. Such conditions are nearly always found in orchards in which raw stable manure has been used around the trees.

Sun-scald.—Blight injury must not be confused with sun-scald which is in reality a mechanical injury and not a disease. It is caused by the alternate freezing and thawing of the trunk. The wood of a tree freezes every winter with very little effect. When, because of severe pruning or some other reason, the trunk of the tree is exposed to full sunlight suddenly, especially on the southwest side, sun-scald may nearly always be expected to result. If one should freeze his ear and use warm water in thawing it, he would probably be so unfortunate as to lose part of his ear. But if cold water or snow were used, the after-effect would be slight. The sun-scalded

Hairy root on apple.

tree experiences this same situation. The winter sun is warmest at about 2 or 2:30 o'clock in the afternoon. At that time it is in the southwest and strikes that side of the tree with its full force, so that the juices are suddenly thawed out on that side of the tree. Then the sun sets and the tree just as suddenly freezes again. As a result the tissues at that period are minutely ruptured—torn to pieces—and die. A similar result doubtless follows severe pruning when the southwest side of a tree is exposed to the scorching, hot summer sun. This is often the case with young nursery trees. Apple trees more than one year old will have become tender from their two years' growth in the shaded nursery row and when they are planted in the open orchard they fall an easy victim to the hot sun. One of the worst features of this scalding is that it provides exactly the right conditions for the entertainment of the flatheaded apple borer that was mentioned in an earlier chapter.

The Illinois canker is a disease of the trunk and branches of the apple tree. The fact that the cankered areas appear to be blistered should afford easy recognition of this affliction. When these blisters are shaved off with a knife, they will be found to extend into and through the inner bark. Each individual blister will show as being marked with a black ring. There is no known control for this disease and whenever it is found, it should be cut out and burned to prevent spread.

Crown gall, or hairy root, is a disease that is not confined to the apple alone. It attacks the roots, usually just at the surface of the ground or a little below. The characteristic evidence is the formation of large, warty knots, often overgrown with masses of hair-like roots, that are easily seen and surely identified. This affection almost always starts in the nursery. It is bacterial in origin and the bacteria gain entrance to the plant at the point where the graft is made. All trees that show any evidences of this affliction should be rejected, for they never make satisfactory orchard trees. It is against the law for any nursery to sell trees having this disease, and money paid for such stock should most certainly be refunded.

Peach scab is among the most common diseases of the peach. A peach so infected becomes mottled with black spots, which eventually cover the peach, finally turning it completely black and during this process cracking it open. This disease is widely distributed over the country, so that there are few peach orchards not suffering from scab. It is easily controlled by spraying with a self-boiled lime sulphur solution.

Brown rot is another disease of the peach that also attacks the plum and cherry. It attacks the fruit in very much the same way that the mold affected the bread as described in the early part of this chapter. The disease starts with the planting of the spore of the fungus on the fruit, usually by the wind or by some insect. Bees are a pest in a peach orchard at harvest time, because they are always crawling about over whatever rotten fruit is present, and then drag their bodies over the sound peaches in their search of the sweet juices of the fruit. In this way they spread serious infection. When the spore starts to grow, the fungus causes a discoloration of the fruit in a constantly widen-

Brown rot of the peach. These dried peaches hung on the tree all winter and remain infective the following year

ing circle. Eventually the peach becomes brown all over and then the grayish spore bodies appear on the surface. These rotten fruits will remain on the trees all winter and are a fertile source of infection for the next year. This disease is always much worse if there is warm, wet weather at the time of harvest. This assertion recalls the fact that in growing mold on bread the moisture was kept in by a glass cover. Many plant diseases will thrive under similar conditions. Spraying the peaches with the self-boiled lime surphur early in the season will remove much danger of infection. In the case of cherries, especially sweet cherries, this disease is suspected of causing unfruitfulness in some localities. In such circumstances the fruit was all destroyed before it was given opportunity to develop. A few applications of self-boiled lime sulphur have been known to correct this condition so that trees that had been barren for years, produced a record-breaking crop.

Leaf curl is a fungous disease of the peach that would be quite serious if it were not so easily controlled. It manifests itself by curling the leaves of the plant as soon as they come out of the buds in the spring. In fact the spores of the disease are present on the twigs all winter, seemingly waiting for the leaves to give them a chance. Late winter spraying with strong lime sulphur will kill the spores of the disease and at the same time eradicate any San José scale that might be present. This point illustrates the fact that the business of spraying is not a simple one and the grower must have the situation well in hand if he desires to accomplish most work with the least expenditure of money and labor.

The peach yellows is a highly important disease, so important, in fact, that it deserves special attention. It is a physiological affection, which means that nothing tangible is known about it. Scientists have studied it for thirty years or more and it still remains as little understood as it did at first. Many growers and some scientists are beginning to

feel that yellows has a distinct relation to winter killing. It it known that the yellows is more likely to appear after a severe winter. It is also claimed that potatoes grown in the peach orchard will cause the yellows. Scientists have scouted that theory, but it has recently been suggested that it agrees with the belief regarding winter injury. When potatoes are planted in an orchard, they are cultivated until midsummer and then permitted to rest. The stoppage of cultivation naturally checks the growth of the peach trees. Later in the fall the potatoes are dug and in digging them, the peach trees are incidentally given the most severe cultivation to which they have yet been subjected. Growth naturally starts again and the tree enters the winter in a vigorous growing condition—entirely unseasoned against the severity of the winter. The next year yellows often appears in the orchard. This riddle of peach yellows will undoubtedly be solved in the near future, but in the meantime nothing can apparently be done as a corrective.

The black knot on the plum is a disease that affects the twigs and branches of the tree. The Japan varieties are almost never affected by it, and, since it is difficult to control, the wise orchardist will avoid planting the sorts that are subject to it. The only means of controlling it is to cut out and burn the affected branches.

The leaf spot, or shot hole fungus, causes spots to appear in plum leaves. Later these spots fall away, leaving a round "shot hole." To remedy this the trees should be sprayed with strong lime sulphur solution before the leaves open, and during the summer they should have several applications of self-boiled lime sulphur.

The black rot of grapes causes the berries to turn brown at first, then black, and finally to shrivel away. The spores develop on these first berries attacked and the disease will soon spread over an entire vineyard. Some varieties are much more liable to rot than others. For relief the vines

Peach yellows.

must be sprayed in the winter with strong Bordeaux or with winter strength lime sulphur. During the summer the vines must be sprayed regularly as directed in the chapter on spraying.

Anthracnose on grape causes a circular spot on the berries and also forms a small canker on the canes. Severe pruning to remove the damaged canes and spraying as for black rot will help control the infestation.

Anthracnose on berries.—Another disease, also called

Grape anthracnose.

anthracnose, appears in whitish spots on the canes of raspberries and blackberries. Eventually the canes die, and the fruit is always much poorer in quality and less in quantity on diseased plants. The old canes should be cut out and the new ones sprayed with Bordeaux.

The leaf spot of strawberry is sometimes a serious disease, although it does not damage the fruit directly. The

One leaf of cucumber diseased in grape vine.

Strawberry leaf spot.

fungus forms small spots in the leaf and weakens the structure so that it is unable to continue in its normal functions. Badly infested beds should be plowed under or burnt as soon as the crop of fruit has been harvested. Sometimes the practice of burning over is decidedly beneficial, as it kills not only the diseased leaves, but also eradicates numerous leaf-eating insects. In newly planted strawberry beds the plants should be sprayed with Bordeaux mixture at frequent intervals.

CHAPTER VIII

SPRAYING.

Need for spraying.—For all the reasons mentioned in the foregoing paragraphs, none is of more significance than spraying. Not so many years ago it was possible to grow good fruit without any special attention other than an occasional pruning and cultivation. The trees in those days were free from pests, and fruit generally was of good quality. Nowadays the fact that the trees must be sprayed thoroughly, if a fair crop is to be produced, is generally recognized. Every citizen the application of the right spray at the right time makes all the difference between a full crop of fruit and none at all. In one instance a large wheat country town advertised that the trees were badly infested with pests very heavily. The trees were unusually large and each year it bloomed freely but had never produced any fruit. The owner of the farm decided that in the twenty years preceding

he had never seen any ripe sweet cherries on the tree. By the form alone it was decreed a sweet cherry in the neighborhood, but no one knew whether the color of the fruit was yellow or deep black. This tree was sprayed and produced that year over sixty gallons of fine Royal Ann cherries. With similar spraying it has done equally well ever since.

Spray materials.—In order to understand spraying fully, a general knowledge of spraying materials must first be obtained. These may conveniently be divided into three classes, viz., contact insecticides, internal poisons, and fungicides. The word "insecticide" simply means a preparation that will kill insects. Fungicide is the term applied to those solutions used to kill fungus.

Contact insecticides.—There are three contact insecticides in almost universal use in orchards. The practical grower must know what they are and how they are prepared and used.

Lime sulphur solution.—The first and most important of this group is the lime sulphur solution. This is a mixture of lime and sulphur in which the sulphur, or part of it, is brought into solution by boiling it with lime. Sulphur by itself is only slightly soluble in hot water. By mixing it with lime and boiling vigorously, the lime and sulphur form a combination that is soluble. It is this combined sulphur and lime that constitutes the insecticidal part of the mixture.

The common method of preparing the solution is to take fifty pounds of good unslaked lime and add enough water to cover. Then add fifty pounds of sulphur and stir well. As soon as these ingredients are well mixed, enough water should be added to make one hundred and fifty gallons altogether, and the entire mass should be boiled until it develops a deep coffee color. This process will take from thirty minutes to one hour, according to the intensity of heat applied. The solution may be prepared in large iron kettles or might better be made in wooden tanks into which steam pipes from a small boiler are permitted to discharge. By using live steam in this manner the amount of heat may be easily controlled at all times.

Concentrated lime sulphur.—There is now on the market a preparation known as concentrated lime sulphur solution which many orchardists have adopted in place of making the mixture as it is needed. If properly used, the commercial solution is just as good as the home-made and all the labor of making it is avoided. Since the home-made material should be freshly prepared as it is used, it will be easily seen that it will require time for preparation just when the fruit grower can least spare it. By using the commercial solution all the available time is devoted to spraying instead of being taken up in the preparation of the spray. The commercial solution is usually of a uniform strength and can easily be tested to make sure that one quantity is exactly like every other. For this purpose an instrument, called the hydrometer, is used. The hydrometer is made of glass and is so constructed that it floats in any solution in an upright position. A graduated scale on the glass indicates the strength of the solution. There are many different hydrometers made for testing various substances, but the one used in connection with lime sulphur is

Using the hydrometer.

known as the "Baume" hydrometer. On this scale the fresh, undiluted commercial lime sulphur should test not less than 32 degrees. When diluted for use it should test not less than 7½ to 8 degrees. The directions put out by most manufacturers will advise diluting the material till it tests only 5 degrees, but this recommendation should not be followed, if good work is to be expected. It is generally conceded that 5 degree lime sulphur will not kill all the San José scale; and so the wise orchardist will use his material at the higher strength.

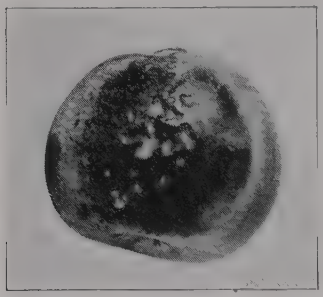
Tobacco is the base of another kind of contact insecticide that is used for summer spraying against soft-bodied insects like the plant lice. The lime sulphur solution at winter strength can not be used while the trees are in foliage because it is so caustic that it will burn the leaves. It is for this reason that the tobacco preparations are used during the summer. Tobacco tea may be prepared by boiling stems and refuse leaves in water, but the ordinary grower has no means of knowing whether his solution is sufficiently strong. Here again the manufacturing chemists have been of good service by preparing a tobacco solution of known and uniform strength. There are several preparations on the market which contain not less than 40% of nicotine sulphate, which is the important ingredient in the solution. This is the strongest preparation of tobacco that has yet been made and it is a very violent poison. It should be handled with care and stored out of reach of children. The solution is diluted for use by adding from 500 to 1000 parts of water according to the insect that is being eradicated. Since these preparations vary somewhat with the different brands, it is safest to follow the directions provided by the manufacturer. These strong preparations should not be confused with the weak and mostly inert mixtures, that are offered by some firms. It is a wise precaution to examine the label on any tobacco preparation and assure one's self that the article contains not less than 40% nicotine sulphate.

Coal oil emulsion is a contact insecticide that is not as popular as formerly. At one time it was widely employed for the control of the San José scale in winter, and, in a dilute form, for the control of plant lice in summer. At the present time it has been largely supplanted by the lime sulphur solution and the tobacco preparations. There are still a few situations in which the kerosene emulsion may prove of value. This is particularly true in regard to some of the scale insects like the oyster shell scale, which are most easily destroyed when the eggs are hatching in the spring. The emulsion is made as follows:

Chipped hard soap	½ pound
Water	1 gallon
Kerosene	2 gallons

Heat the water and dissolve the soap in it. Add the coal oil and churn vigorously. At first the mixture becomes milky, but soon becomes quite as thick as soft butter. As it grows cold it hardens and may be kept some time without having the oil separate out. For summer use it should be diluted with from twelve to fifteen parts of soft water. If soft water is not obtainable, a small portion of borax must be added to make a smooth solution. In use this preparation must be carefully observed as it is likely to injure tender foliage. This possibility varies with the weather conditions, and, because a certain strength solution failed to injure a certain plant on one day, is no assurance that it will not injure the same sort of plant the next day. As a rule, warm, dry weather is favorable to its use, because under such conditions the oil is evaporated more quickly. On cool, moist days the oil will remain on the foliage longer and to most plants kerosene is a positive poison.

The "miscible oils" are very similar in their action to the coal oil emulsion. There are several brands made by various manufacturers. They are all prepared under the same principle and as purchased they all appear to be a heavy dark oil. This oil, when mixed with water, makes a milky



Spray injury on apple.

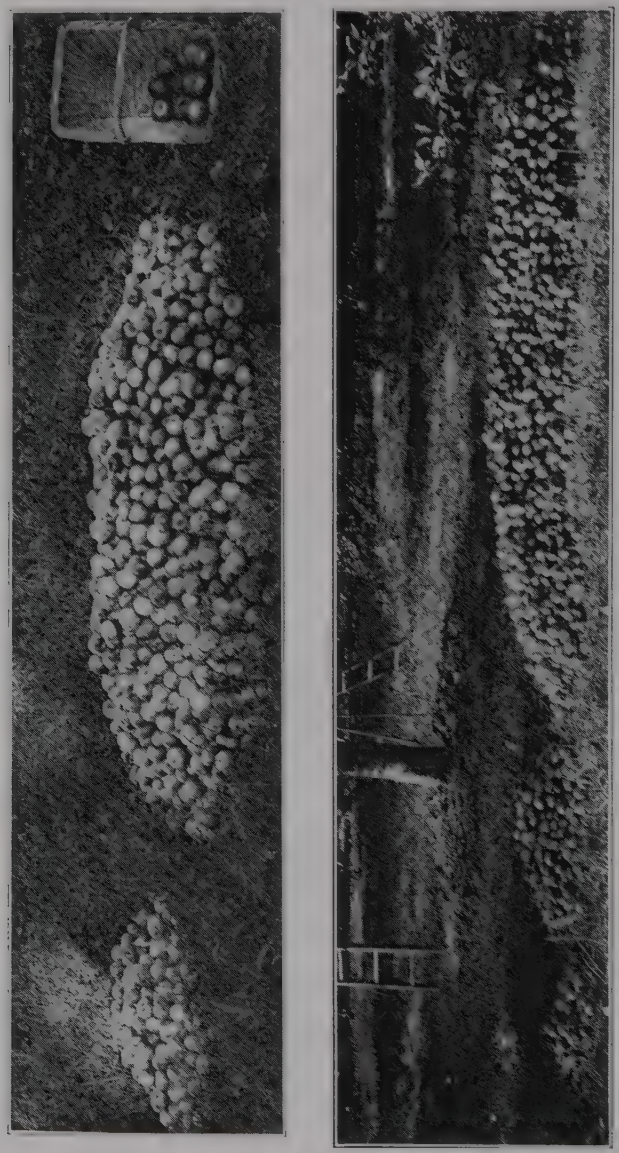
solution. If used strong enough, these solutions will kill most varieties of scale insects; but they have an unfortunate record of having killed many trees also. Their use is generally regarded as dangerous, and careful fruit growers are avoiding them whenever possible. The lime sulphur solutions will accomplish all and more than any of the miscible oils and without any of the element of risk attached to the employment of the latter class of insecticides.

Internal poisons.—There are only two internal poisons sufficiently important to be mentioned here. They are arsenate of lead and Paris Green. Arsenate of lead is a chemical preparation of arsenic and lead. During the past few years it has come into almost universal use as the best internal poison. It can be prepared at home, but the home-made substance varies in strength to such an extent that no practical orchardist will attempt to make his own. The commercial composition has been standardized and all that is sold must come up to United States government inspection. As a result the orchardist is protected from getting an impure chemical regardless of the brand he purchases. As supplied by the trade, arsenate of lead is a pure white paste containing about 50% water. A newly-opened package will resemble a package of ready-mixed paint in that the heavy portion will be settled and more or less caked at the bottom. This hard cake should be carefully stirred up until the contents of the original package is of a uniform consistency. None of the water in the package should be poured out as it is all counted in with the weight of the substance, and, if part of the contained water should be poured off, a paste would result which would be materially stronger than would be anticipated. The well-mixed paste is to be applied at the rate of from two to three pounds to each fifty gallons of spray solution.

Dry arsenate of lead.—Recently some manufacturers have been making a feature of dry powdered arsenate of lead. In most cases this is simply the ordinary paste form, dried and ground. As a result this product is not so finely divided as is the paste—that is, the particles of arsenate of lead are larger in the dried form and consequently do not remain in suspension as long as the paste does. Thus the poison settles in the spray tank and the solution as it goes on the tree is not uniform in strength. The saving in freight, the convenience in handling, and the accuracy in weighing are all in favor of the dried substance; but until the present time at least, the paste form has procured the best results in the orchard. With improved methods of manufacture the dry form will soon doubtless be made quite as effective as the paste.

Paris Green is a combination of arsenic and copper. It was widely used before arsenate of lead came into general use. It is not now so extensively employed as formerly except for certain pests. It is more likely to injure the fruit and the foliage, and it is altogether more expensive than the newer poison.

Fungicides.—The preparations that are used as fungicides are interesting on account of the methods which occasioned their discovery. Many years ago the grape growers near Bordeaux, in France, were much annoyed by having their fruit stolen by tramps. They made a mixture of lime and copper sulphate and sprinkled it on the vines nearest the road to make it appear as if the grapes had been poisoned. After this had been done several times they discovered that the vines that had been sprinkled were not only unmolested by the thieves, but were growing more vigorously than their neighbors farther from the road. In this accidental way was discovered the preparation which has ever since been known as Bordeaux mixture. It is probably the best general fungicide that is now known in spite of the fact that it has some undesirable characteristics. It consists simply of the mixture of two solutions, one of copper sulphate and the other of lime.



Top—Apples from unsprayed tree; first pile, windfalls, 1½ bushels; second pile, imperfect fruit, 9 bushels; third pile, perfect fruit (in basket), 12 apples. Bottom—Apples from sprayed tree of same size in same row; first pile, windfalls, ½ bushel; second pile, imperfect fruit, 2 bushels; third pile, perfect fruit, 1½ bushels.

The solutions are prepared separately, and then diluted and mixed. The following formula is in general use:

Water	50 gallons
Copper sulphate	4 pounds
Lime	4 pounds

Stock solutions of both lime and copper should be prepared in advance, as the copper is not easily brought into solution. The best way to prepare these stock solutions is to weigh out a given number of pounds of copper sulphate, place it in a burlap bag, and suspend it in a barrel containing the same number of gallons of water as pounds of the chemical. After the copper is all dissolved the resulting solution will represent one pound of copper for each gallon of water. Similar measures should be taken in the preparation of the lime solution. When ready to start spraying, take four gallons of each of the solutions, dilute them separately and then mix. Unless special diluting tanks are at hand, this is somewhat troublesome and the same results can be obtained in the following manner. Take four gallons of the copper solution, place it in the tank of the spray machine which has been previously almost filled with water, and stir vigorously. If the machine is equipped with an agitator, this solution may be easily mixed by working the pump a few moments. While the solution is being stirred vigorously, add the four gallons of the lime solution. The solutions should never be mixed in the concentrated form, as the resulting combination is not nearly so effectual. If the spray tank holds more than fifty gallons, proportionate quantities of the stock solutions can easily be used.

Self-boiled lime sulphur.—Probably second in the list of fungicides comes the self-boiled lime sulphur mixture. Its value as a fungicide was discovered from the fact that it was at first thought to be a means of controlling the San José scale in the summer time. It failed to accomplish the latter purpose, but proved itself to be admirably adapted to the work of

controlling certain plant diseases. The self-boiled lime sulphur mixture differs from the lime sulphur solution in that it is simply a mixture of the two chemicals made in a specific way, and not a chemical combination. It is prepared in the following way:

Good unslaked stone lime	8 pounds
Flower sulphur	8 pounds
Water	50 gallons

The lime is placed in a barrel and enough hot water added to slake it. Hot water increases the heat which is normally generated in slaking. As soon as the hot water is poured on, the sulphur must be added and the entire mass stirred for a few moments. It should boil vigorously from its own heat so that no artificial heat need be applied. If the solution is permitted to boil long enough, some of the sulphur will combine with the lime and the resulting compound will be a clear coffee-colored liquid which rises to the top. This action may be remembered as very similar to the one obtained in the preparation of the lime sulphur solution. For fungicidal purposes it is not desired that the cooking should progress farther than this stage. *Just as the brown liquid begins to form*, cold water should be added to stop the boiling. In practice, it is customary to add enough water to complete the required fifty gallons. The preparation is then ready to spray on the trees. Care and judgment are necessary in the preparation of self-boiled lime sulphur, but if the fruit grower learns to check the boiling at the proper time, he may well believe that his undertaking is becoming successful. This fungicide has an advantage over Bordeaux mixture in that it can be applied to any kind of foliage without the danger of burning. It is also the only satisfactory spray for use on peaches and plums. It is not so vigorous in action, however, and has not proven that it will perfectly substitute the Bordeaux in the apple orchard.

Commercial lime sulphur.—A dilute solution of the commercial lime sulphur is another fungicide with which every

Filling a spray tank.

fruit grower should be familiar. All the lime sulphur solutions have the power of killing fungous growths or preventing such diseases. The commercial lime sulphur, however, is so strong in its action that it must be greatly diluted when used in the summer as a fungicide. The usual method of employing it is to weaken the commercial material with forty parts water. At this strength it is not injurious to the apple tree, but will probably cause serious burning on the leaves of the trees bearing stone fruits. Dilute lime sulphur solution is extensively used as a first spray on apples and the Bordeaux is applied later.

Dusting.—Formerly spray materials were much employed in the form of powder or dust which was blown over the trees by special blowing machines. There have been recent attempts to revive this form of treatment; but, for the most part, the agitation has been made by the manufacturers of dusting machines. In practically every instance the use of dust has not given as good results as the wet spray.

Spray machinery is now made in a great variety of styles, but the most common outfits are the barrel and power rigs. The barrel outfit is designed to be used by hand. It consists of a barrel to contain the spray material, a pump to force the liquid out, and a stirring device to agitate the solution in the barrel. Many spray materials tend to settle if allowed to stand and the agitator, as a consequence, is a highly essential

part of the outfit. The pump should by all means be made of brass, and should have a sufficiently large air chamber to maintain a uniformly high pressure. Most barrel outfits will furnish enough force to supply only one line of hose. In fact, it is unwise to attempt to make them supply more than one line, for a lowered pressure would most assuredly result which would be greatly detrimental to efficient service. All pumps should be provided with a gauge to determine pressure, which

Winter spraying.

should never read below 100 pounds on hand pumps and 175 pounds on power pumps. But higher pressure can be maintained at whatever point the power plant is able to furnish. More solution is required if applied at a low pressure, and it will not prove so effectual. The high pressure breaks the spray substance up into small particles and provides a very thin coating for the entire tree.

The barrel and pump can be mounted on a low sled or set in a small wagon. If the ground is rough, the sled is much to be preferred for it is less likely to upset. The spray outfit

must also include fifty feet of good half-inch rubber hose, an extension rod and a good nozzle. The hose should not be shorter than the length specified, because a shorter hose will prove a handicap for good work. When a tree is being sprayed the workman must go completely around and spray all sides of it before he can consider his work well done. The long hose will enable a man to spray an ordinary tree without moving the machine. The hose should have been made for spraying and should not be an adapted garden hose, which can not endure the high pressure and which will quickly be rotted by the chemicals. Good half-inch spray hose should last for three years and should not cost more than from fifteen to seventeen cents per foot. Extension rods are made of bamboo, lined with a thin brass tube. The brass tube is threaded at both ends so that the nozzle can be attached to one end and the hose to the other. There should be a good brass cut-off valve between the hose and the rod. All these parts can now be procured of standard size, so no difficulty should be encountered in the matter of proper fittings. Nearly all bamboo rods are made alike, and, as a rule, are perfectly satisfactory. Never use an iron pipe as an extension rod, because it is heavy and difficult to handle and flakes off inside, thus clogging the nozzle. Iron extension rods are furnished only with the cheapest outfits. Nozzles are of various styles, which differ with the manufacturer. The nozzle known as the double Vermorel has long been popular with fruit growers, and is capable of extremely effective work. Its only possible objection is the ease with which it becomes entangled in the branches, but this has no weight with the careful workman.

The disc type of nozzle has come into general use in the past few years, and is steadily gaining in popularity. To the experienced, however, its only obvious advantage is that it does not catch in the branches, thus facilitating speedier work, but this fact might easily become a disadvantage since careful spraying is to be encouraged rather than speedy work.

The Bordeaux nozzle throws a fan-shaped sheet of spray.

It is not used to any great extent by practical growers, but is often used in spraying shade trees because it throws a large volume of spray, thereby insuring quick work.

Power sprayers are built on the same principle that is used in the hand pumps except that the power for running them is supplied by a gasoline engine. This type of outfit is usually provided with a tank which will hold from one hundred to two hundred and fifty gallons of spray material. The smaller sizes are best adapted for hillside work, as they are much more easily handled.

Power pumps are built with either one, two, or three cylinders. The three cylinder pump, called a triplex, has practically three times the capacity of the single cylinder and is a very efficient pump. The engine used on any spray machine should be constructed as light as possible and should not be larger than is absolutely needed for the work. It is absurd to haul a heavy four or five-horse-power engine about over the orchard when one of half that capacity and weight would do the work just as well. Experienced orchardists find that a small one and a half or two-horse-power engine gives all the power needed and has the added advantage of lightness. In every case the engine should be just as simple in construction as is possible, for fewer parts to become deranged means less delay on such account. Any gas engine, even the best of them, will need attention from time to time. Keep the machine well oiled and clean it thoroughly after each spraying. It will then require the minimum care and attention.

Small hand sprayers are made in a great variety of designs. Most of them are but little more than playthings, but occasionally such a sprayer will be found most convenient for small work. One of the best types is that known as the compressed air sprayer which is made by a number of different firms. It consists of a tight, brass cylinder holding three or four gallons. The pump is inside the cylinder and is operated much like a bicycle pump. The cylinder is filled partly full of material and the cap screwed into place. Several pounds

of pressure are then pumped up in the can over the liquid, and this pressure forces the spray substance out through the nozzle. For small shrubs and vines around the house, this is quite a convenient outfit, but it does not supplant the larger machine in the orchard or the fruit garden.

Freak sprayers.—There have been, from time to time, several kinds of "freak" sprayers on the market. Most of these are run on the same theory as the little hand sprayer above described, and none has proven in the least satisfactory. The prime objection to them all is that they have no means of agitating the spray liquid. In this respect they have all failed.

Careful spraying.—Regardless of the kind or type of spray machine used, there is one point which the fruit grower must always bear in mind, which is that his work must always be done thoroughly. A man may own the finest spraying machine on earth, and still make a failure of his spraying. I have seen this proposition work out so often in actual practice that I cannot make the argument strong enough. Success in spraying does not depend so much on the kind of machine used as it does on the man who is directing the nozzle. If trees are to be slighted, the money wasted in such manner might better be saved and put into some other business. But the future will be the harvest time to the careful fruit grower —to the one who knows how to spray and is not afraid of work.

Spraying is not a disagreeable task if proper preparation for it is made. In the first place, old clothes must be worn that can be discarded at the end of the season. If the sprayer is not afraid of his work, he will undoubtedly be covered with the spray material. However, the spray solution has no injurious effects on the human animal except a most discouraging odor. The winter strength lime sulphur solution is rather caustic and sometimes burns a tender skin. To avoid any discomfort, everyone who sprays should take the precaution to oil his hands and even his face before starting work. Tal-

low is a good thing to use for this purpose and vaseline is excellent. If glasses are not worn, a pair of large amber glasses, such as are used on bright days in winter or on the water, should be secured. They will most admirably serve the double purpose of protecting the eyes from the strong light as well as the spray. They are better than goggles because the latter fit so tight that they permit no circulation of air about the eyes, which soon become very tired and hot.

Winter or dormant sprays are usually applied for the control of scale insects and for certain plant diseases. The strong lime sulphur solution will control most scale insects and also help control various fungous diseases. Besides it acts as a cleansing wash to the trees, which would make its application profitable even if there were no scales present in the orchard. By cleaning the bark of the tree it seems to put new vigor into every branch. Any spray applied in winter should be used at a high pressure so as to drive the liquid under the small flakes of bark and into all the cracks and crevices. Scale insects prefer such sheltered places, which are also convenient for the lodgment of the spores of diseases.

The first spray to be applied to apples is usually put on when the buds are first showing their pink color. This should consist of the commercial lime sulphur solution diluted with forty parts water. To this is added two pounds of arsenate of lead to each fifty gallons of solution. The combination makes a spray solution that is effective against leaf-eating insects and against such fungous diseases as the apple scab. This spray is designed to eradicate the scab, the curculio and the bud moth.

The second apple spray is applied just after the petals fall. This spray is intended primarily to control the codling moth and is often called the codling moth spray. It will be remembered that the codling moth usually enters the fruit at the blossom end. The object of this treatment is by using high pressure to force the spray substance into the calyx cup of every blossom. A little later in the season, as the young

The proper time to make the application of the second spray. Notice that the petals have fallen, but that the calyx lobes are still open.

apple begins to grow, the lobes of the calyx curl inward and close the cup. Unless the fruit is sprayed before these lobes close, very limited opportunity remains for controlling this pest. A dose of spray poison must be inserted into each calyx and the young codling moth will be poisoned at its first bite toward eating his way into the apple. The dilute lime sulphur is used as a basis in this spray which is identical with the first spray.

The third application is made about two weeks after the second and has the same object in view. It is to a certain extent a "good measure" spray, so if any of the spray work is to be left undone, this third spray should be the one neglected. The identical dilute lime sulphur solution is used as in the first two instances.

In spraying for the lesser apple worm a very high pressure should be maintained and a nozzle used that will form a very fine mist. In the codling moth spray a high pressure was used to drive the poison into the calyx cup. In the control of the lesser apple work a spray will be needed to coat all parts of the tree and all parts of the fruit as well. For this purpose I have found that the triple Vermorel nozzle, with a pressure of at least 200 pounds, will give by far the most satisfactory results. Other attempts at controlling this pest with a disc nozzle have absolutely failed.

Peaches should be sprayed just as the calyx cups are being crowded from the growing fruit. These little husks protect the young fruit until it is two weeks or more old. In this early stage spraying would do no good because the poison could not be brought into contact with the young fruit. This spray controls the scab and in a measure it also controls brown rot. Where the latter disease is serious the trees should have a second, and perhaps a third, application later in the season. The self-boiled lime sulphur solution with three pounds of arsenate of lead paste to each fifty gallons, is the spray used in all summer sprays for the fruit.

In vineyard spraying it is customary to mount the noz-

The proper time for the peach spray.

zles in such manner that they do not need to be turned, and are permanently fixed in position. Enough nozzles are used so that the entire vine surface on both sides is coated at one trip between the rows. This is a similar arrangement to that used in spraying field crops, except that nozzles can be placed in such a way for field work as to cover several rows at a time.

The chief points to remember in connection with any kind of spraying are: first, know what you are spraying for; second, know what you are to spray with, and third, do the work thoroughly.

CHAPTER IX.

Small Fruits.

The term small fruits is applied to the various berries, such as strawberries, raspberries, and blackberries and to currants and gooseberries. All small fruits require special care in planting and cultivating, but are otherwise easy to raise. They seldom require much spraying and are so productive that they are a source of profit to growers. They all come into bearing at an early age, and for this reason they make admirable crops to grow between the rows of trees in an orchard. Strawberries are a practical intercrop in vineyards.

Rich soil is to be preferred in the commercial production of any of the small fruits. They adapt themselves to a wide variety of soils provided that there is enough available fertility present to force them into a sturdy growth from the start. Like all other quick crops, they demand that the fertility be available in order to be of immediate use. On poor soils the plants very often succumb before they are able to establish themselves. It is not advisable, therefore, to attempt the growth of berries on any but the best soil obtainable. New ground, that is, ground which has been recently cleared, is nearly always suitable for small fruits, because it contains plant food in large quantities and is usually in a condition which favors the retention of moisture during dry weather.

Soil preparation.—Next to the fertility of the soil comes the preparation. The ground must be thoroughly prepared before attempting to plant small fruits. Apple and peach trees sometimes grow well in newly cleared ground with very little preparation, but the same is not true of the berries. If

it is planned to use small fruits as an inter-crop in orchards that are planted on new ground, it will be wise to cultivate the land in some other crop for a year before the berries are planted. This practice will insure much better cultivation when small fruits are planted. Without cultivation they are sure to perish. If small fruits are planted on old ground that has been cultivated for many years, some measure should be adopted to restore fertility. A good plan is to sow a crop of cow peas or soja beans and turn them under some time during the fall previous to the planting of the berries in the spring. If old pasture land is used, it should be plowed in the fall and frequently gone over with a spike tooth harrow to break up the sod and to kill the white grubs that are always present in such land. The white grub is one of the chief enemies of the strawberry and also injures some of the other small fruits.

The best time to plant any of the small fruits is in the spring. Assuming that the ground and especially the surface of the ground, has been as well prepared as if a garden crop were to be planted, the actual work is ready to be started. The plants should be kept moist until they go into the ground and should be inspected as carefully as fruit trees. In all cases the roots should be pruned and the tops cut back. The principle involved is exactly the same as in the case of fruit trees. The roots as they come from the nursery are always more or less imperfect and sometimes in small fruits the roots are matted together in a tight mass. These must be thinned out and the top reduced so as to restore the balance between top and root. In planting the various berries the plants should be set just about as they grew in the nursery and the soil must be firmed about the roots. This is one of the most vital points in securing a good stand of plants. After planting, the berries should be regularly cultivated and no weeds should be permitted to grow near them. The cultivation should start within a very short time after the plants are set. Some strawberry growers cultivate the day after the plants are set

The ultimate aim of the berry grower — shortcake.

and keep the ground loosened throughout the season. A safe rule is to cultivate about as for a crop of corn or potatoes. Strawberries are an interesting crop, easily grown, and, on good land, they are very profitable. A single acre has been known to clear as much as five hundred dollars, but the average profit is much less than this, owing to poor culture, poor varieties, or low market prices.

Strawberry varieties must be given special attention, because a variety that is a success in one section may prove a disastrous failure in another. Do not plant too large an acreage until you know what varieties are suited to your ground and climate. If no neighbor has made a success of strawberries, it will be best to plant a single row of several varieties and observe results. The next season suitable varieties can easily be selected and may be safely planted. A few old varieties have succeeded in many different localities. New varieties especially should be carefully tested before being extensively planted. This last precaution applies to all sorts of fruits, but particularly to strawberries. A new variety may prove a wonder for its originator so as to cause him to be perfectly honest in advertising it as a splendid new production. In the adjoining state, however, it may prove worthless, disappoint the planter and give the originator a bad name.

Strawberry plants come from the nursery tied in small bunches of about twenty-five plants each. These bunches should be packed for shipment in crates so that the green leaves are exposed to air. If they were packed in tight boxes like dormant trees many of them would die. As soon as they are received they should be planted, and, if it is impossible to take care of them at once, they should be heeled in. This is done by digging a narrow trench and opening the bunches so that all the roots come in contact with the soil. Lay the plants in the trench and cover the roots and crown with earth, firming it with the foot. In planting see that the plant is set just as deep as it formerly grew. Many strawberry plants

are lost each year by being set too deep or not deep enough. And lastly clip off all but one or two leaves before planting.

Systems of planting.—Strawberries may be planted either in hills four feet apart or in matted rows. In the latter case the rows are four feet apart and the plants are set about twelve to fifteen inches apart in the row. The runners from the plants in the row are kept trained in the row and a mat of plants is formed which will vary in width according to the vigor of the variety. In the hill system the runners are confined to a small space in order to form a compact clump. This method produces very fine fruit, but not nearly so much to the acre as the row system.

Some varieties of strawberries produce flowers with imperfect flower parts. That is, the flowers of certain varieties do not contain pollen-bearing organs and so must depend upon the flowers of other varieties to furnish the fertilizing elements. Other varieties produce flowers that are perfect, containing pollen-bearing organs. Those sorts which produce no pollen are called sterile varieties to distinguish them from the perfect varieties. In growing sterile varieties it is necessary to plant them in close proximity to plants that are perfect, or there will be no fruit or at best only imperfect fruit. This is an important thing to remember, as some of the best varieties are imperfect or sterile.

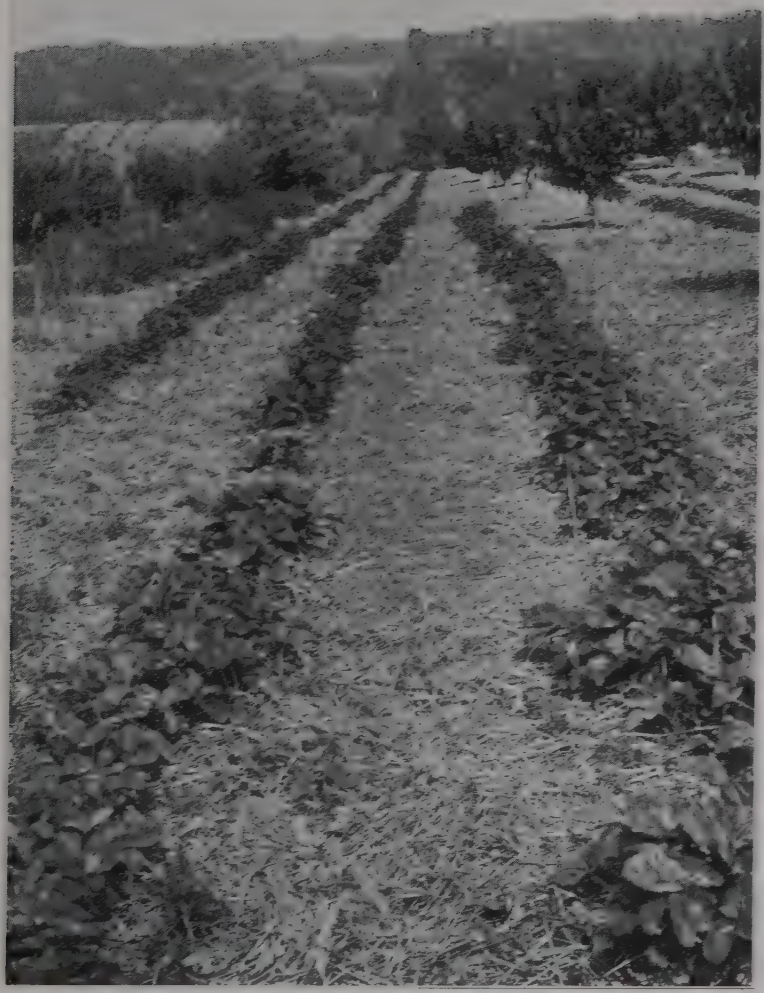
Straw mulch.—In the fall of the year, at the approach of cold weather, the plants should be given a cover of straw. This protects them during the winter and prevents severe injury to the roots caused by the alternate freezing and thawing in the spring. The straw should be permitted to remain until severe night frosts are past. When the straw mulch is taken off in the spring, it should be piled in the space between the rows and left. A slight covering of straw should be left through which the plants will be forced to push, in order to keep the fruit off the ground, thereby keeping it cleaner and making it easier to handle. The bulk of straw which is left in the space between the rows will be convenient

to protect the blossoms from possible frosts by covering the plants again whenever such emergency threatens, thus saving the crop.

Burning old beds.—Strawberry beds will bear a crop one year after they are planted; but, as a rule, they are not considered profitable for more than two or three crops. Some growers are satisfied with only one crop from a given planting, while a few permit their beds to stand several years. In such cases it is customary to burn the beds over after they have fruited. The old plants are mowed close to the ground, dried for a few days, and then burnt. This treatment kills all leaf-eating insects and eliminates much of the leaf spot disease. Afterward the space between the rows should be well cultivated and manured. Such precaution will sometimes rejuvenate an old bed and make it profitable.

Everbearing strawberries.—A recent introduction in the strawberry line has been the everbearing variety, which is simply a sport from the older sorts that tends to produce its fruit in the fall instead of the spring. As a matter of fact, such varieties product berries in small quantities all summer, but never enough to make them profitable. They are of value chiefly to the man who grows only a small amount of fruit for home use. In some seasons the ordinary varieties produce fruit in October, often enough to make a profitable harvest, and they have even been known to ripen under a light fall of late October snow. Such occasions are experienced only rarely, but it is probable that in some favorable year, the everbearing varieties may yield a profit. The cautious grower, however, will permit others to do the experimenting.

Raspberries.—There are two main classes of raspberries —the red and the black. The red and black varieties are also crossed with each other, producing a purple sort that is quite popular. Red raspberries are propagated by separating the suckers from the old plants. These suckers or sprouts are generally produced in great abundance, even resulting in one of the great sources of trouble in planting this sort of



Strawberries in a young orchard. Notice straw mulch.

fruit. By this method of propagating, the nurseryman also propagates and distributes the root gall disease. As a consequence root galls are to be found almost everywhere that red raspberries are grown. In some sections the disease has wiped out the red raspberry industry. All plants of this variety should be carefully examined to make sure that the roots are in a healthy condition before they are planted. The

Clean culture among raspberries.

black raspberries are propagated by layering and are, therefore, much less annoyed with root disturbances than are the red sorts. The tips of the black raspberry canes are permitted to grow until they touch the ground when they are covered with earth. In a short time they take root. The following spring they may be separated from the parent plant and dug for transplanting.

Raspberries should be planted in rows above five feet apart and about three feet apart in the row. Some growers

place them even farther apart than this distance. Constant cultivation is necessary to insure a good growth. The plants will produce a few berries the next year after planting and should be ready for a full crop in two years from planting. Wires are sometimes used to support the canes, but most of the large growers depend on pruning to secure a stout stem which will hold up its load of fruit without artificial support. No mulch is required on raspberry plantations until the second summer. Then a light mulch of straw should be placed around the plants to help hold the moisture during the dry weather. At this time the plants are so outspread that they can not be cultivated as closely as during the first summer and the straw mulch simply takes the place of cultivation. If preferred, the mulch may be placed next the plants and a space left between the rows in which the cultivator may continue its work.

Raspberries should be pruned in the spring before growth begins. If pruned in the fall they are liable to die back from the point where they were cut, thus causing a still further loss of fruit bearing wood. As a rule they may be shortened from one-third to one-half their length. The resulting fruit will be better and the stem stouter. After fruiting, the old cane should be cut out and all the strength of the plant permitted to go into the new shoots.

Blackberries grow wild over a large part of the eastern United States. They prefer a clay loam, but sometimes are found growing in quite sandy places. They grow best in those soils in which they grow wild. This is one reason why they are not more extensively cultivated. The wild crop in favorable years amounts to enough to keep the price of the cultivated fruit so low that the grower makes no profit. In sections that have been settled for a long time and where there is no waste land, it may prove advisable to plant blackberries commercially, but there is still a great quantity of wild fruit supplied to the markets each year. This supply in some cases is so great that the fruit is shipped by country

buyers to distant markets. They are there doubtlessly sold as cultivated berries. Blackberries are propagated in much the same manner as are raspberries. Their culture is about the same as that of the raspberry except that they should be planted farther apart (from six to eight feet) and they should be pinched back each summer as soon as the canes are about three feet high. Such pruning causes the canes to branch and become very stiff in order to hold up a great load of fruit. Dewberries are a species of blackberries, but are produced on vines that run on the ground. They are not commercially important.

Currants are easily grown except in heavy clay soils. They require plenty of moisture and do not endure drouth well. Their cultivation is the same as for raspberries, but they should be planted four feet apart each way. They are propagated by cuttings taken from the old plants in the fall. These cuttings should be planted at once and they will start to grow the following season. In some conditions they are permitted to grow for two years before planting. The fruit of the currant is produced on old wood and for that reason very little pruning is desirable. The important facts concerning their culture are to keep the plants from crowding and take out all dead wood. Borers may work in the older canes and give cause for their removal. The red currants are the most popular and are by far the most easily grown. There is always a ready market for them and the supply never seems to be able to keep up with the demand.

Gooseberries are grown much the same as currants. The European varieties are subject to mildew and for that reason they should not be planted. A few good crosses between American and English varieties have resulted in a fruit that is of high quality and still fairly free from mildew. The variety known as Downing is said to be such a cross. The demand for gooseberries is not so great as that for currants and they are not being so widely planted. A few plants will furnish all the fruit that an ordinary family will possibly use.

Novelties.—There are frequently new varieties or new kinds of berries brought to the grower's attention, and some of these deserve a slight notice on account of the fact that they are usually downright fakes. A few years ago a so-called plant wizard heralded what he was pleased to call a new garden huckleberry. It proved to be a member of the nightshade family, devoid of flavor, utterly useless and entirely unlike any known huckleberry, to which family it did not even belong. More recently the Himalaya berry has been widely advertised. All trials of it seem to indicate that it is a totally worthless variety and that it usually kills to the ground each winter except in the extreme south. So instead of being a hardy plant from the highest mountains of India it is so tender that it can not withstand the mild winters of the south central states. All novelties that are advertised as being "the greatest ever" should be regarded with suspicion until their worth is proven.

Small fruits for back yards.—Nearly any of the small fruits can be grown with success in a city back yard with the possible exception of the blackberry. All of the others are small growing plants or bushes and do not require much room. Currants and strawberries can also be grown in portions of the yard too shady for other uses. They will not do so well as if they had full exposure to sunlight, but in a shaded strip along the north side of a board fence or shed they will produce a very fair crop.

A bed of everbearing strawberries ten feet square has been known to supply enough fruit for a small family in the city. For city growing it is probable that the everbearing strawberries are the best. At no time will they bear as full a crop as the older commercial sorts, but they will produce a small amount of fruit over a long period.

This is also true of the everbearing raspberries, of which the St. Regis is the best. Twenty-five plants of this variety will supply more fruit than the average family can use and its production will be extended throughout the entire summer.

Cuthbert is another good red raspberry that has been a success in city gardens. Raspberries, however, should only be planted where they can have full sunlight throughout most of the day as they are not shade enduring.

The successful growing of any of these small fruits in a city back yard depends upon the use of exactly the same sort of care in the preparation of the soil, planting, cultivating, etc., as is necessary when the same fruits are grown on a commercial scale in the country. Accordingly all that has been said of their general culture is applicable to their successful growing in the city.

CHAPTER X.

Harvesting.

Under the heading Harvesting, will be considered the picking and packing of fruit. This subject is highly important to the grower, because, if proper attention is not accorded this phase of the business, an entire season's work might be lost. Many good crops of fruit have been ruined because they were not properly picked and many more have been seriously injured by improper packing.

Picking.—No other feature of fruit growing requires more careful attention than the picking of the fruit. In the "good old days" apples were shaken to the ground and gathered into piles in the open, where they were permitted to remain until the necessary time was found to put them under

Women and girls make successful apple pickers.

shelter. These methods are always wasteful. No grower need expect to realize a profit from fruit handled in such manner. Unfortunately, however, a few men still persist in trying to harvest their fruit in such a way. One of the first points to learn about harvesting any fruit is the proper time to pick it. Some crops are ruined if allowed to hang too long, while others will yield greater returns and will be of better quality if they are permitted to stay on the tree as long as possible. The market should, in some cases, be considered, because fruits intended for the use of a nearby market can

The crop from an average seven-year-old tree in a well-cared-for orchard.

be permitted to ripen more fully on the tree than if they were to be shipped a great distance.

Time to pick.—Apples will vary in the time of picking with the variety. Ordinarily they should be gathered as soon as they acquire their full color, but there are some exceptions to this rule, which will be dwelt on at greater length. Some growers prefer to have their apples remain on the trees till the stems part readily from the twig. This condition usually means full maturity of the fruit. In some cases, nevertheless, it is not desired that fruit should be fully ripe at picking time. If part of the crop begins to fall to the ground of its own accord, that is an indication that the fruit

should be picked. Most growers do not wait for the fruit to reach this state of maturity. The Ben Davis should hang as long as possible, for the color and quality are thus improved. This variety will keep better, however, if picked as soon as it is well colored. The Winesap should not be gathered until it acquires full color and the stem parts from the twig easily. The Grimes should be picked before it becomes clear yellow

Perfect fruit represents a profit. Imperfect fruit is often a loss.

in color; in fact, it is better picked while the skin is still perfectly green. A yellow Grimes will rot easily, while if picked green, it will sometimes color well in storage. The Delicious should be gathered as soon as it is well colored. Like the Grimes, it is a poor keeper if allowed to hang too long, but if picked while still hard and firm, it will keep till May in cold storage and come out in perfect condition. The Jonathan must be picked even before it is well colored, for it will be much less likely to develop the Jonathan fruit spot if gath-

ered slightly green. The Stayman resembles the Winesap in that it should be allowed to hang as long as possible, otherwise it sometimes withers in storage. Summer apples are usually picked as soon as they will do to cook regardless of their state of maturity. A few varieties, such as Red June and Liveland, grown chiefly as eating apples, should be allowed to color well before being gathered. Yellow Transparent and Duchess may be picked as soon as they are well grown. It is a good practice to make several pickings of summer apples because they do not all ripen at the same time on the same tree. The last picking may be left to mature more fully and be disposed of in local markets.

Picking peaches.—The proper time to pick peaches will vary slightly with the variety and the distance shipped to market. Ordinarily the fruit is given opportunity to soften a bit without becoming ripe enough to eat. The average commercial peach as it comes from the tree is certainly far from being a tempting fruit. Some varieties, like the Elberta, can be picked quite green, will ripen in transit, and will open up on the market perfectly ripe. Other sorts, like the Greensborough, which is a splendid peach when ripened on the tree, will not ripen rapidly after being picked. The variety has this defect and many growers will not plant it for this reason. Peaches allowed to ripen on the trees are always of much better flavor than those shipped to market green or half-green. If they were left to become soft on the tree, however, they would be too ripe for use by the time they were purchased by the city customer. So few city people know the flavor of the fine orchard-ripened fruit, that they accept the ripened-in-transit peach without question. It is a safe guess, however, that the experienced fruit grower would not eat his own product if he had to take what arrives in market. It is one of the rewards of the fruit grower to have all the fine fruit he wants as nature intended he should, direct from the tree.

Pears are almost always picked green and ripened in

storage. They are better in flavor and in quality when handled in that way than if they were permitted to ripen on the tree. Western growers pick some varieties as soon as they are large enough to sell readily, and they invariably reach the eastern market in good condition.

Plums are usually gathered before they become fully ripe. The Japan sorts color well after being picked. They should be quite firm if they are to be shipped any distance.

The America plum—a cross between the American native and the Japanese type of fruit.

Cherries should be picked as soon as they become well colored. The sweet kinds should be taken off as soon as they develop the sweet flavor, but before they become fully ripe.

Grapes should ripen well on the vines, as they do not change much after picking.

Small fruits must be picked when they are well colored. Strawberries are sometimes picked before they acquire much color, because they do not bear up well under shipment. Raspberries are gathered when they separate easily from the stems. Blackberries

are similar to raspberries in this respect. Currants are taken off while still slightly green, or at least as soon as they show color. Their chief use is for jelly-making and, if too ripe, they are less desirable for that purpose. Gooseberries must be plump, but quite green, for in this condition they are most salable.

Care needed.—There are several points in regard to the picking of the various fruits that must be borne in mind. In picking apples the fruit must be firmly grasped in the hand, with the thumb pressed against the stem forcing it tight against the apple, and then the fruit is given a slight twist, thus causing the stem to separate from the twig. Care should be used to pick the apple with the stem entire, but with no portion of the twig. The next year's fruit bud is often formed close to the stem of the apple, and careless picking will cause the spur bearing the new fruit bud to break off and remain attached to the apple. Such a practice will not only lessen the chances for a plentiful crop the following year, but also furnishes a bit of sharp cornered twig that will puncture the skin of the apple wherever it touches other apples. Apple pickers should always have their finger nails closely trimmed. A very slight injury might result from a sharp nail which will readily provide a place for the spores of rot-producing fungi to enter. The apples should be picked preferably in baskets or in specially constructed canvas picking bags, but never in grain sacks. Apples gathered in sacks will not only bruise each other, but risk greater injury from being crowded against the branches by the picker. Remember that the apple is a valuable fruit and accord it the same treatment as any other high-grade product. The fruit should be gently laid in the receptacle—not thrown. And when containers are emptied the fruit should not be poured out, but should be lifted out carefully.

Peaches are picked with the same care as apples. Having very short stems, they should better be twisted off so as to separate cleanly from the tree. If they do not part from the stem easily they are probably too green to be harvested.

Where pickers—local Arabs are usually employed in orchards and vineyards and picked fruit is taken to the packing shed where they are to be marketed. The necessary packing is the wood box, and a tray is generally provided for the pickers which will hold four or six of these boxes. The pickers fill the boxes in the field, but the careful grower will repack each

A packing shed

box to ensure himself that the bottoms are filled with good clean fruit.

Packing sheds.—As soon as any fruit is picked it should be taken to some central place, usually a packing shed, and there packed for shipment. Packing sheds are of any size or arrangement according to the individual needs of the grower. Sometimes a tent erected in a fairly cool spot

serve as a small fruit packing center, to which all fruit will be brought to be crated. Some small fruit growers build sheds, and the apple and peach growers will, of course, have extensive facilities for the handling of their fruit under cover. Apple packing houses are generally much larger than those for peaches, because the peach crop moves in and out of the packing shed promptly, while the apple crop may be permitted to accumulate for several days before being shipped.

Apple packages.—There are two standard packages for apples. The barrel has for years been the standard package in the East and the bushel box in the West. Recently there has been a tendency on the part of eastern growers to adopt the box as a standard package and it is gaining in popularity every year. One fact that has hindered the general adoption of the box in the East is lack of information on the part of eastern growers. Through inexperience they have lacked the skill required in packing boxes and they have not realized that the box package is suited only to strictly fancy fruit. Old-fashioned methods which still prevail over a large part of the eastern apple districts have resulted in the production of large quantities of poor fruit. Imperfect fruit is not suitable for box packages and it is a great mistake to attempt to market it as such. Wherever good fruit is produced, it will pay the grower to investigate and learn how to pack the box. This skill can not be accomplished by reading the directions in a book and can be learned only by actual first-hand experience. There are a few principles of box packing, however, that can be stated concerning the proper procedure and which when mastered will do much to assist the practical application of such knowledge.

Apples for box packages should be sorted for size, color, and condition. Apples of different sizes can not be packed in the same box and be expected to result in a standard pack. The color should be uniform throughout the box. Concerning condition, it should be emphatically borne in mind that no im-

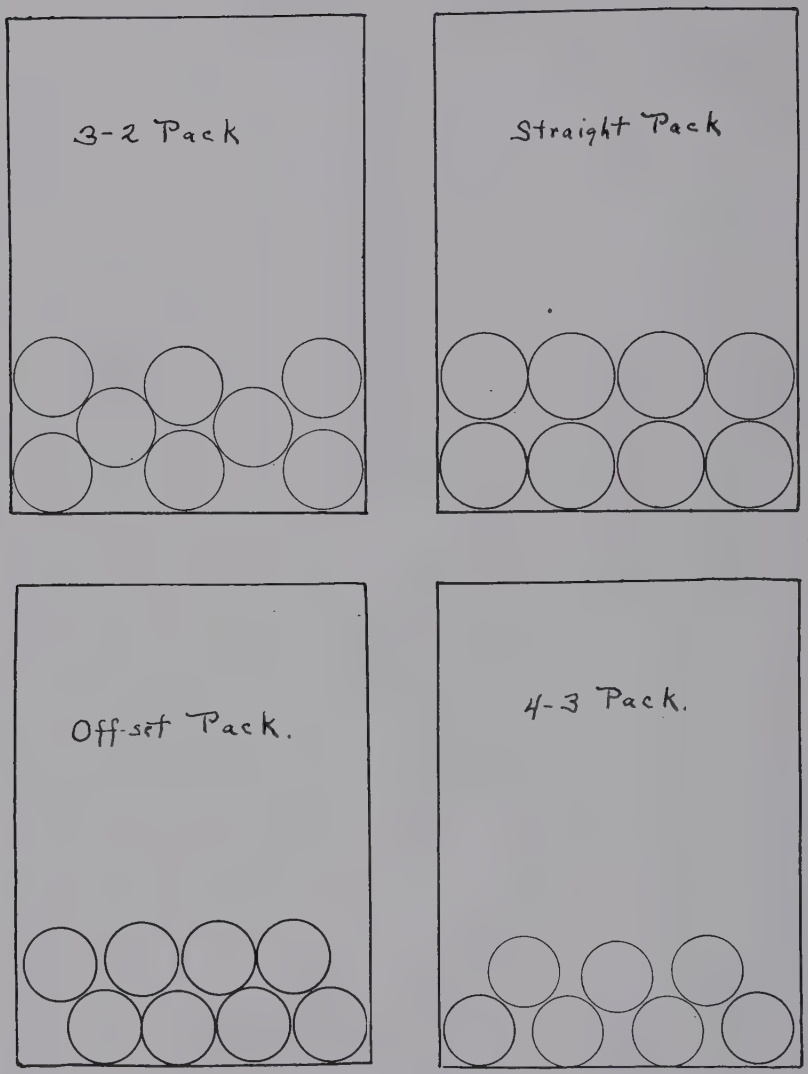
A well-packed box of apples.
(Photo by H. H. Odmark.)

perfect fruit can be tolerated in a box package. Boxes must be packed with perfectly clean fruit, entirely free from rot, scab, worms or any mechanical blemish. Each apple should be wrapped separately in paper. The box should be lined with paper.

The standard apple box measures 10½x11½x18 inches, inside measurements. The top and bottom must be made of thin, flexible boards. Place the empty box so that the bottom is inclined from the back towards the front. Line it wtih white paper, ordinary unprinted newspaper stock, in such a way that two flaps of paper are left to cover the top of the box. Have a supply of thin, soft paper cut about ten by ten inches in size, to wrap the fruit. A rubber finger tip pulled over the thumb of the left hand will enable the sheets of paper to be picked up easily and quickly. Take up a sheet of paper so that it lies flat in the left hand, select an apple with the right hand, place it in the center of the paper with the blossom end down, and twist the flaps over and around the fruit. Be sure that the stem of the apple comes at the point where the corners of the paper are folded or twisted, for if it were placed in the center of the sheet, it would perforate the paper and possibly injure the apple next to it. There are several systems of placing the apples in the box which vary with the size of the apple. The pack known as the "three-two" pack is an easy one for beginners and is adapted to several sizes of fruit. First apples are placed in the two lower corners of the box. Then one is paced midway between these two, which leaves short spaces between the end apples and the middle one. The next row consists of only two apples which occupy the spaces mentioned. The next row repeats the arrangement of the first row, consisting of three apples, and so on alternately. When the first entire layer has been arranged in the box, the apples should be so tightly packed that there can be no possible movement of one apple against the other. When the box is completely filled, the apples should extend above the top of the box for a distance of one-

half inch at each end and one and one-half inches in the middle. This bulge is produced by turning some of the apples in the middle of the box so that their longest diameter will extend perpendicularly. Some packers use a slightly larger apple in the center of the box, but the really fancy packs are made by using apples that are quite uniform in size. When the box is full the paper is folded over the fruit and the lid is nailed in place. A box press is generally employed in nailing on lids. The reason for making the top and bottom of the box of thin material is to accommodate the bulge in the pack. When the lid is pressed on, some of the bulge is pushed down to the bottom so that both top and bottom will bulge approximately the same. The thin, flexible top and bottom act as springs to hold the fruit firmly in place and prevent it rolling about and becoming bruised. If there should be any shrinkage in storage, the top and bottom boards will still keep the package tight. In storing and shipping boxed apples they should always be piled on the sides, which are of thicker material and will prevent the fruit from being crushed. Other styles of pack include what is known as the "straight" pack, the "two-two," the "four-three," the "offset" and other packs. Most of these are good, but the straight pack should never be used unless the size being handled can not be packed in any other way. The objection to the straight pack is that each apple bears directly on its neighbors, thus almost certainly bruising the fruit. The various styles of packs are diagrammed in the accompanying illustrations.

The barrel package is adapted to apples that do not grade high enough to be put into boxes, although some eastern growers still pack their finest fruit in barrels. Formerly there was no standard size for apple barrels, and, as a result, fruit reached the market in barrels that held from two and a half to four bushels. The barrel has now been standardized in most apple-producing states and, while the prescribed measurements will vary slightly in the different states, the barrels all hold practically the same, viz., three bushels. A barrel of



Showing the start of four different packs for box apples.

that capacity will measure about sixty-four inches around the bulge, seventeen inches across the ends, and have staves twenty-eight and a half inches in length. The government has adopted a certain standard for the packing of apples in barrels, and fruit so packed and so labeled must come up to certain requirements. This rather absurd standard is not much used by growers because it tolerates the presence of ten per cent. wormy apples. The box has not yet been standardized by the government, and still it is practically impossible to find an imperfect apple in a box packed in any of the sections which have familiarized themselves with the smaller packages. Growers realize that good fruit is their best advertisement, better even than any artificial government standard. Every grower should attempt to pack his fruit in such a way that it will be above suspicion rather than in accordance with a special standard. If it is perfect fruit, then it will be above any standard yet established.

In packing a barrel of apples, a layer of corrugated paper should be placed in the bottom of the barrel. Then a layer of apples is laid in with the stems down. In fancy barrel packs two layers are placed in this manner. Then the fruit is carefully poured in from containers that can be lowered into the barrel. The barrel should be shaken frequently to settle the apples as much as possible. It should be remembered that when they are shipped, they will receive rough handling so it is necessary that they be packed solid to avoid bruising. Fill the barrel and then carefully put on another layer of apples with the stems toward the top. Lastly place another sheet of corrugated cardboard on top and then head the barrel. Place the barrel in a barrel heading press, loosen the top hoops and force the head into place. This process will crowd the fruit down into the barrel and no doubt injure some of it slightly, but will not damage it as greatly as if it were permitted to rattle around loosely in the barrel on account of slack packing. After the head is forced into place, tighten the hoops. Some practice is, of course, needed in order to do this quickly

Barreled apples in a packing shed waiting to be hauled to the station.

and neatly. Do not use too many nails in fastening the heads, only enough to hold the hoops securely in place. Remove the press and tack lining hoops in the head at each end. Lining hoops are sections of curved wood to fit inside the staves on the head of the barrel, to prevent the head from working loose. Lining hoops should always be used, if the barrel is to be shipped. The label should be put on the end of the barrel which was down while the fruit was being packed. That end will open with a more uniform show of fruit and create a better impression than will the other end. Neatness of pack is an important feature in selling fruit.

Early apples are often sold in bushel baskets, which are convenient containers for such fruit, but should not be used for winter packages.

Peach packages will vary in different localities. Some sections ship all peaches in bushel baskets, while others ship in crates containing six small baskets. For fancy fruit the latter is a very attractive and popular package. But it is slightly more expensive than the bushel basket and requires more skill and experience in packing. Its relation to the peach trade is the same as that of the box to the apple trade, i. e., it is adapted only to fancy fruit.

Plums are shipped in a variety of packages. In the West they are marketed in small crates containing several small, square baskets. In the East the Climax basket is a popular package. It is a veneer basket with a handle, resembling the grape basket, but much larger.

Grapes are packed in four- and eight-pound baskets, which are fitted with a thin, wooden top to be held in place with a specially bent wire staple.

Small fruits and cherries are sold by the case or crate, which contain either sixteen or twenty-four quart boxes. Red raspberries are often sold in pint boxes. Formerly this class of fruit was sold by the "drawer," which was a large flat tray holding as much as the grower desired. The drawers were returned to the grower and used over and over again. They

soon became dirty and unsightly, and their use has been discontinued by all progressive growers. The crates of small boxes always present a neat, clean appearance and while they cost more, they nevertheless demand a better price for fruit.

Tight pack.—No matter what kind of fruit is being packed, or what sort of a package is being used, fruit must be packed tight. The package must be completely full and must be filled in such a way that there will be the minimum of settling in transit. All packages should be neat and clean and should bear the name of the grower and the name of the variety of fruit contained. The ultimate aim of the fruit grower is to sell the fruit he produces. A clean, honest package is the best advertisement possible in the selling of fruit.

An old orchard in full bloom.

CHAPTER XI.

Marketing.

Uncertainty of conditions.—After a crop of fruit is grown and packed, it remains to be marketed and this detail is often by no means a small part of the year's work. The experienced fruit grower does not purchase a luxurious new automobile as soon as he learns that his peach crop has not been killed by cold weather; nor does he begin to plan an extensive pleasure trip when the buds begin to show color. He realizes instead that his year's work is not assuredly safe until he has the money from its disposition in his pocket. Profits on fruit are often very large, much larger than on any other crop taken from the soil, but the grower remembers from experience that there are many chances of loss. A hail storm may ruin a fine crop of fruit on the day before it was to have been harvested. Then, a crop may be gathered, escaping the hail, only to encounter overstocked markets with prices so low that the returns will not pay the freight. Fruit may spoil in transit, or it may rot in storage; and last of all, dishonest commission men are still doing business. Loss from that source is probably now less than formerly, and as time goes on, there is every indication that the dishonest dealer will be eliminated, so that the sale of fruit will be conducted on a basis that is fair to both the producer and the middleman.

Methods of marketing.—There are a number of ways of disposing of a crop of fruit. If the grower does not have too large an acreage, and has easy access to markets, he may peddle his products from door to door. It is probable that this method yields the best returns, because it eliminates the

cost of transportation, commission, and multiple handling. Of course such methods are impossible if the orchards are extensive or if they are far from market.

Parcel post.—Some growers sell their fruit direct to the consumer by advertising in local papers and magazines. Since the advent of parcel post this scheme has gained considerable favor and has been reported as giving excellent results. If fruit is to be sold by parcel post it must be packed in a light, tight package that comes within the size and weight limits of the postoffice regulations. Since these regulations are as yet frequently changed by the postoffice department, it seems unwise to publish any measurements that may be in effect at the present time. The grower who contemplates sending fruit by parcel post should consult the local postoffice authorities regarding permissible sizes of packages and rates to various points. In advertising fruit for sale the grower must first decide on a fair price for the fruit itself. The first expenditure will be for the corrugated cardboard packages in which the fruit is to be packed, the packing of the fruit and the postage. Then the cost of advertising should be estimated and the sum of expenditures incident to shipping, added to the actual value of the fruit itself, should give the proper price at which to quote the fruit in the advertisements. For instance, if the orchardist thinks he should secure forty cents net for his fruit, he must add to that forty cents the cost of the package, about seven cents, the cost of packing, about three cents, and the postage, about fifteen cents. This gives a total of sixty-five cents, which is the theoretical price at which he should advertise his fruit, but the cost of advertising must not be overlooked. It has been found that the cost of advertising on this class of produce amounts to from fifteen to twenty-five per cent, of the selling price. Consequently the above-described peck of apples could not safely be advertised at less than seventy-five cents per peck.

Consider the cost.—There is a large and growing demand for apples and other fine fruits supplied from the producer

direct to the consumer, and it is probable that the parcel post will help develop this class of trade. The grower must exercise care that his selling expense does not eat up his profits; and the illustration just given will furnish a fair idea of the relation between the net selling price of the grower and the actual purchase price of the consumer. Many orchardists do not stop to figure the cost of growing and packing their fruit. They think that a certain sum of money returned on a crop of fruit should be all profit. But a record should be kept of the work done on the orchard. Accounts of the costs of pruning, spraying, cultivating, picking, packing, and selling should be filed so an intimate knowledge of the selling price can be obtained in order to estimate a profit. Producing a crop of good fruit is an expensive process. But a good product is, at the same time, very valuable. When a selling price is set, see that it is high enough to make a fair return on the investment, and is also a reasonable price for the consumer to pay. It is human to expect to sell more low-priced apples than high-priced ones, but, if a customer cultivates the habit of buying fruit, he will soon find himself unable to do without it. If the public would form the habit of eating fruit not once in a great while, but every day, such a condition would not only help sell fruit, but would not be a detriment to the victims of the habit. It will be one of the habits that will be of untold benefit to the ones who practice it.

Commission men.—Probably the most common way of disposing of fruit is through the medium of the commission man. A commission merchant is one who receives fruit from the grower, sells it for him and then sends the receipts, less the commission, back to the grower. Often the commission firms are blamed for failures of which they are not guilty, but some authentic cases on record prove that the dealer, evidently not satisfied with receiving his rightful commission, tried to appropriate the entire shipment. However, for the average grower the services of the commission man are indispensable. He is the only means of communication between the producer

and the consumer, and in nearly every case the price expected for his work is very low, when the amount of work and worry involved is considered. A commission man will receive a shipment of fruit from the grower, pay the transportation charges, drayage charges and in some cases will have to repack the fruit. These costs are charged against the selling price of the fruit and are deducted from the amount finally sent the grower. No charge for store room, salesmanship, book-keeping, or advertising is entered, for these items are all covered by the ten per cent. commission which the dealer extracts from the selling price as his pay. In return for this ten per cent. commission, the grower secures the equivalent of a store of his own in the city, with the added advantage of not being confined to any one store or any one city. So the middleman appears to be a very useful link in the chain between the orchard and the city purchaser.

Association selling.—In some localities a different system of selling has been organized, known as association selling. The growers form an association which will sell all fruit produced under their brand and guarantee. In the northwest and in California this plan has been developed most satisfactorily, so that the growers have been enabled to secure better prices for their fruit as well as to reach distant markets with relative safety and ease. The influence exercised on the growers by these associations has also been highly beneficial, because such organizations have adopted a very high standard of quality and have insisted that fruit sold under the association brand must meet those requirements. This idealism has resulted in making the growers more alert in the control of pests and more careful in the packing of boxes and crates. As an extra precaution every package that is sold has an identification number on it so if its contents caused complaint, the source can be easily traced. The cost of selling through associations is not quite so high as the cost of selling through the agency of commission dealers, but, on account of a recent increase, a few growers in the Northwest have indicated their dissatisfaction

with association methods. Probably association plans have not yet been developed to their utmost perfection and will steadily increase in popularity. The association plan is not practical unless there are a number of growers located near each other, all of whom are experts capable of producing the very highest grade of fruits. Association methods are not adapted to the selling of low class produce, because one of the features of the plan is the advertising which the fruit receives, and it is very poor policy to advertise worthless commodities. Any article should be just as good or preferably a bit better than described by the advertisement, in order to realize the best returns.

Soft and quickly perishable fruits are, of course, sold as soon as they are ripe enough to ship. A few growers sell their fruits on the tree, with the stipulation that the purchaser should manage the picking and packing. The price received in such an arrangement must be low enough so that the buyer has a safe margin to cover any possible risks, for none are assumed by the seller in this case. Occasionally, however, the grower will sell his fruit for less than it actually cost him to prune, spray, and cultivate, merely because he had no means of ascertaining these costs.

Apples are often sold on the tree, but more frequently the grower chooses to pick and pack his own crop. Then the problem of the proper time to sell confronts him, for which there is only one solution. The best rule to follow is to sell whenever a price is offered which will pay a reasonable profit. There is sometimes heavy loss connected with the continued storage of fruit. There has been a tendency toward planting apples that are known to keep well with the expectation of holding them in storage until spring, when a good price will be demanded. This practice is often a great mistake. One grower picked and sold his Jonathans before they were much more than half colored, as cooking apples. Since the market for such apples was brisk at that time, he realized five dollars per barrel for his crop. His neighbors laughed, held their apples until spring, paid storage on them and finally sold the crop for three dol-

lars per barrel. It is not an unusual experience to find that storage charges have consumed the profit on a crop, with the storage bill amounting to as much as the cost of producing the fruit. Such exorbitant charges should be controlled by a state public utilities commission, with the hope that in the future these gross over-charges will be righted. In some localities the growers have combined to build small storage houses of their own, thus reducing the costs to a minimum. All old horticultural books for three-quarters of a century have presented plans for the construction of apple store houses, but the idea has never become popular possibly on account of uncertain conditions.

Altogether, there is no branch of the business of fruit growing that requires as much judgment as the selling of the crop. It is the final test of the grower's ability, in which too many growers fail.

PART II

GARDENING

GARDENING

CHAPTER I.

Planning the Garden.

The family garden is a universal institution, but is not developed to the same state of perfection in our United States as in foreign countries. Very few farm homes exist at the present time without the customary kitchen garden, but in rare cases are they cultivated to the best advantage. In most situations the entire management of the garden is left to the women of the household. The men have not realized that the returns from a well-kept garden are just as valuable and more important than from any similar area on the farm. As a result the status of the American garden has remained very much as it was a century ago. We have not been so alive to the improvement of the quality, quantity and variety of our vegetables as of our fruits. In many instances the garden space is still devoted to a few staple vegetables, such as beans, corn and cabbage.

Foreign gardens produce not only a great quantity of the old standard foods, but in addition they grow a much greater variety of vegetables than are ever found in the American garden. Numbers of old farmers are known to exist who have never eaten asparagus and seemed to consider it as an ornamental shrub to be grown in the door yard by the "women-folks." As a rule the improvement of the varieties in our American gardens has been the result of the work of a few

specialists and the commercial seedsmen. After a new sort is introduced and cataloged for a number of years the seedsmen have gradually retired the less worthy sorts, and the public has blindly purchased whatever was offered. Fortunately the public has benefited by the outcome, which has been evolved with very little coöperation on the part of the individual planter. This statement is not meant to reflect on the success of the occasional progressive grower, but to stimulate the laggard into a realization of what he is losing.

Vacant lot gardens.—Practically every farm has its own garden. Recently many city folk have taken up gardening, and as a consequence, the vacant lot garden idea has spread rapidly. In most of our American cities enough vacant land exists which, if cultivated, would supply vegetables to the entire town. It has been said that the entire Japanese nation could live on the products from the waste land in our American fence corners. This theory is especially true in regard to waste land in cities. Most cities enlarge their boundaries in a manner that exceeds all normal demand. A land owner at the edge of town will decide to dispose of his holdings in the shape of a new city addition of lots, so the ground is taken out of cultivation and divided into small parcels. It is not, as a rule, rapidly taken for building purposes, so for a period of years it lies idle, when it could very well be used for garden space. The idea of vacant lot cultivation is a worthy one that should be encouraged to increase in popularity. Such work will be a step toward the highest economic development. It will mean the production of a crop on ground that was previously sterile. The idea of the family garden is not primarily to produce foodstuffs to sell, but to furnish fresh vegetables to the family. If a market can be found for any surplus supply, that will yield additional profit.

Farm gardens.—On the farm there is generally a choice of locations for the family garden. It is extremely advisable not to situate it in an out-of-the-way corner which can not be used for any other purpose. Put it where its importance de-

serves, on the best ground that is available. Choose for the garden a location that has a favorable exposure, where the sun will strike it early in the day and as late as possible. If a slope is used, choose one which inclines toward the east or south, as soil on such slopes will become warm earlier in the spring than it will on a north or west slope. A garden on a hill will be ready for planting earlier than one in a valley and it will not have its plants killed so early in the fall. One season in a garden extending along a hillside the plants at the foot of the hill were killed three weeks before those on top of the hill. In this manner the yield of tomatoes and other plants may be greatly extended.

The soil for the garden should be as rich as possible, and in addition to the native fertility it should be well enriched with stable manure each year. Stable manure is much better than any other form of garden fertilizer for general use, for it not only adds the chemical elements most needed, but also furnishes plenty of humus, which must be present to keep the garden in good physical condition. A well manured garden soil will retain moisture longer and will require less cultivation than one that has been given little or no manure. Chemical or commercial fertilizers should be avoided in garden work as they have never proven better than manure and in many cases their long continued application tends to destroy the texture of the soil, causing it to become pasty.

Locate the garden as conveniently to the house as can be managed. As the products of the garden are to be used chiefly by the family, the site chosen should be close enough to the home to be easily and quickly reached from the kitchen. Such a location will prove not only a convenience, but a great time-saver for the women of the house whose time and labor should be conserved as carefully as that of the men.

Arrangement.—In arranging the different plants in the garden it is well to have the perennials at one side along with the space for hot beds or cold frames. Perennial plants are those that live from one year to the next, planted perma-

nently in the garden. Among them are asparagus, rhubarb and the herbs, such as sage. Some herbs are annuals, but it is well to have them occupy the same space from year to year. The portion of the garden that is devoted to annual crops should be arranged in long rows or in flat beds. The old style of making garden provided for raised beds, with paths between them. These raised beds were objectionable in several ways. In the first place they were adapted to hand cultivation only. It was impossible to use a horse in such an arrangement and even the modern wheel hoes were found impractical for use in such beds. Then, too, much good space was wasted by the large number of patches that were necessary, and moisture was wasted as well. By raising the beds, a greater amount of surface was exposed for evaporation and, as a result, the soil dried out very quickly.

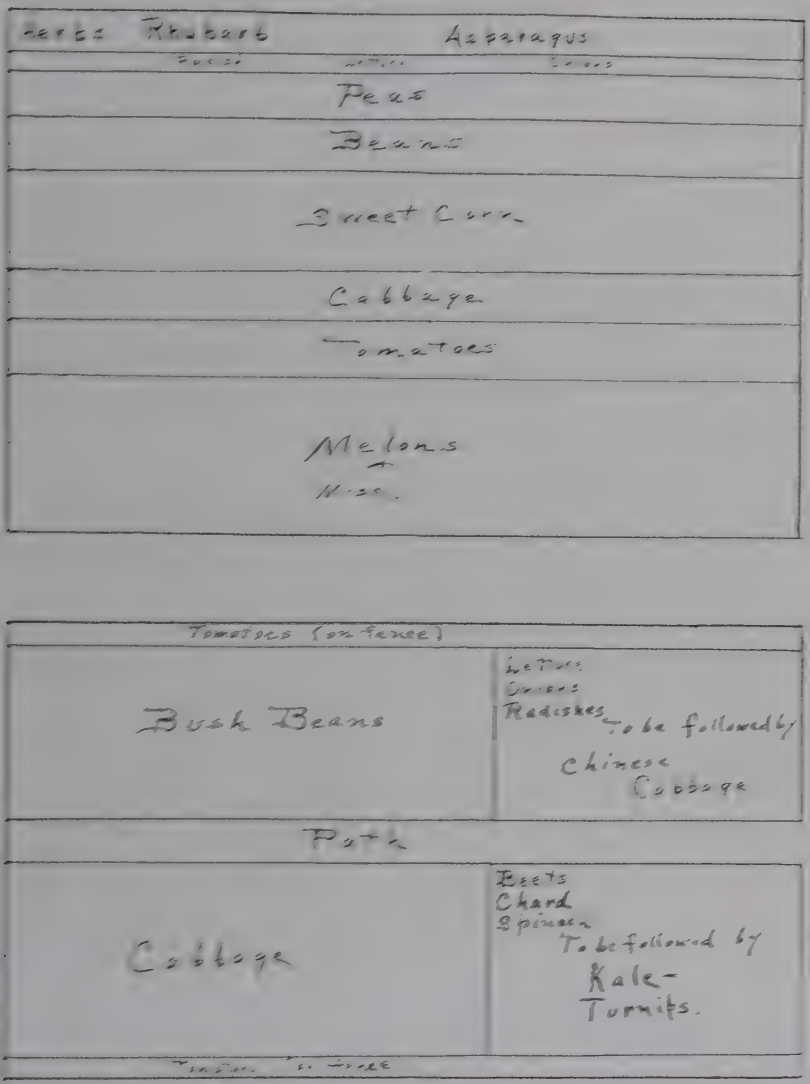
Manure.—The garden plot should be given a heavy cover of well rotted manure in the fall of the year, which may be plowed under either at that time or very early in the spring. Whenever it is plowed, it must be plowed deep, for that is one of the secrets of good gardening. Unless the soil is turned to an unusual depth the garden will suffer during the hot weather which is likely to appear any summer. After the ground is plowed it must be worked down well with a good harrow. Some gardeners use a disc harrow after the plow and follow the disc with a spike tooth harrow and a board drag. The intention is to secure a well packed seed bed that has been loosened to as great depth as possible. Such soil conditions provide for the prompt germination of the seed and for its continued growth during the season.

Long rows in the garden reduce cultivation work to the minimum. Every farmer knows that it is much easier to cultivate a field of corn in which the rows run the long way of the field than one in which they run the short way. When the rows are long, fewer turns of the cultivator will be needed, and it is on the turns that the most time is consumed. This fact is particularly true of gardens in which a horse is used

to cultivate the crop. It is also true of those gardens in which wheel hoes are used. Another advantage of the long row is that it economizes more space than the short row. Low-grow-

Plant the garden in long rows so as to make cultivation easy

ing plants should never be planted between rows of tall growing crops. Plant low growers at one side of the garden and tall growing vegetables, like corn and pole beans, at the other side. Rotate the planting each year so that the same crops will not occupy the same soil twice in succession. This prac-



Upper—Suggested plan for a farm garden.
Lower—Suggestion for a garden in a city back yard.

tice is simply good farming, but is not really so necessary in the growth of garden crops as it is with the usual farm fields, for the reason that a more liberal supply of manure is presupposed for the garden than for the regular crops of farm grains and grasses.

Double crops.—Often the garden space can be so arranged that two crops of vegetables can be secured from the same ground in the same year. There are many combinations that can be used to secure this result. By obtaining an early start, many of the spring vegetables will be harvested before it is too late to plant the customary summer garden. As an example, sweet corn may follow a crop of early peas. The peas, being a legume, really improve the soil to a certain extent, making it more productive for the crop of sweet corn which follows. Lettuce and radishes are quick-growing, cool weather crops which mature early and which are worthless if permitted to stand too long. The plan, then, is to force them to a quick growth early in the spring, use them while they are prime, and finally utilize the space for later vegetables. Beans are a good crop to follow these spring relishes, but cabbage or tomatoes may be used. Later sowings of lettuce may be planted to follow the early crop of the same vegetable and the same theory is true of sweet corn. If the first planting of sweet corn is of an early maturing variety, it will ripen in time to make way for a later planting of the same sort which can be used in the fall. Crops which mature about midsummer, such as early cabbage, corn and some kinds of beans, can be succeeded by plantings of kale or spinach for fall use. The accompanying diagrams indicate some plans for the average garden, but they are, of course, to be modified to suit the individual tastes of the growers. Crops to follow early seedings are also indicated.

Fencing.—The garden should by all means be enclosed by a good fence, which should be so constructed as to exclude all farm animals and especially chickens. Small mesh wire fence is most often used for this purpose and is probably the best

and cheapest material. Some gardeners prefer to build a tight board fence, but such a protection is expensive to build, and has the added objecton of providing too much shade for economical planting. Gates must be furnished large enough to permit the entrance of the manure wagon and enable cul-

The garden drill.

tivation by horses. Some growers have designed their fences in such a way that the fence at either end consists of a series of removable panels which can be quickly taken down while the garden is being plowed and cultivated. Such an arrangement enables the horse to be turned outside of the garden and results in clean cultivation to the ends of the rows with no danger of uneven rows where the horse turns. This kind of

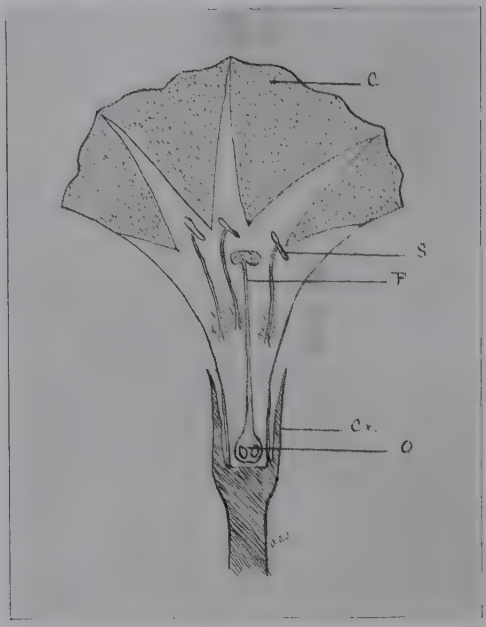
fence costs but little more than the ordinary tight fence, and if it is built properly, is just as serviceable as if it were made of continuous wire. At all events a garden fence should be built substantially and permanently. A few growers believe in changing the location of the garden every limited number of years, but there is no good reason for such a theory. Well-kept gardens will continue to increase in productiveness each year, if they are properly tilled and regularly manured. Old garden soil should be very rich and warm. Why should years be spent in building up a productive soil only to change the garden to a new locality? The gardens of Europe have been in use for generations and without exception they are more fruitful than any of our American gardens. With them intensive gardening has become a necessity, while with us it should be practiced before it is our last resort.

CHAPTER II.

Seed Selection.

Seeds.—During recent years a great deal of attention has been given to the question of seed selection and, as a consequence, many important discoveries have been made. In the discussion of the propagation of fruit plants the point was developed that it was impossible to pedigree fruit trees, because of the fact that reproduction in the nursery is purely vegetative. The blossom with its attendant mixture of pollen does not play any part in the growing of a young fruit tree, A scion (twig) is simply cut from the tree which it is desired to propagate, and this scion is induced to grow in a seedling root. The young fruit tree is merely an extended growth of the tree from which it came. In this same relation the point was established that fruit trees that grew from seed seldom produced fruit similar to that of their parents. These two points should be kept in mind when considering the selection of garden seeds.

Flower parts.—In order to understand the manner in which a seed is produced, a fundamental knowledge must be first established concerning the typical flower parts of a plant. On examining any common flower it will be found that it consists of certain very definite parts whose shape and arrangement may vary somewhat on comparison with other flowers, but whose functions are similar in nearly all cases. On the outside of the flower, and often covering it in the bud, will be found certain green leaf-like divisions. These parts are called sepals and together they form the calyx. Inside the calyx is another row or rows of divisions forming in most



Flower Parts: Cx Calyx. C. Corolla. S. Stamens. P. Pistil. O. Ovary.

cases the showy part of the blossom. These parts are called petals and when considered as a whole, they form the corolla. Inside the corolla is a row of slender stalks surmounted by a cap of powdery yellow or orange. These are the stamens and in the center of the group of stamens is found a heavier stalk, usually with a sticky end, which is called the pistil. The parts which are the important ones in the work of the flower are the stamens and the pistil. The pistil is connected directly with the ovary in which the seeds are produced, but the seeds can not be developed until some of the pollen which is produced in the stamens is transplanted to the sticky top of the pistil. When the pollen reaches that point, it quickly develops a microscopic tube which passes down through the stalk of the pistil and unites with the embryo seeds in the ovary. In some plants only pistils are found present and the plant is forced to depend on the pollen of its neighbor of the same species. The pollen from one species will not fertilize seeds of another species. Radish pollen will not fertilize lettuce seed, but pollen from yellow corn will readily fertilize the seed of white corn. In a few cases it is found that, while both stamens and pistils are found in the same flower, the seeds are more readily fertilized by pollen from some other individual plant. This general mixing of

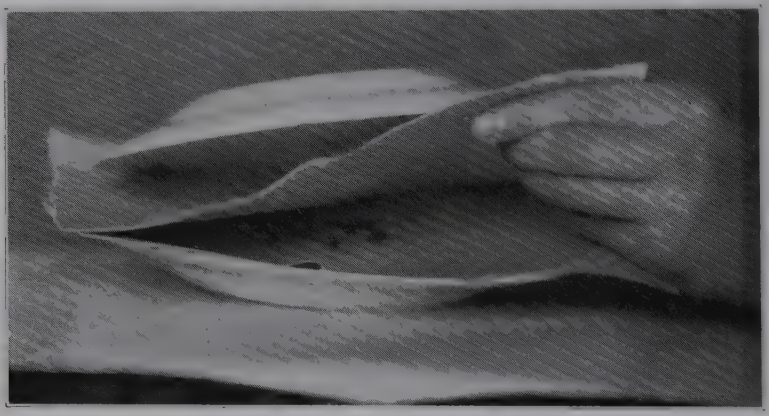
pollen results in seeds almost hopelessly mixed and it also accounts for the great variation found in plants grown from seed.

New varieties.—At this point the question naturally arises relating to long established varieties that have remained the same for many years, such as Burpee's Bush Lima bean, Livingston's Stone tomato, Golden Bantam corn, etc. The first step toward answering this question is to ascertain how these varieties originated. To begin with, some gardener or seed grower probably noticed a particular plant in his garden which seemed to be better in some respects than others of its kind. Sweet corn is a good plant to consider as an example. In a field of mid-season corn a grower finds a stalk which ripens its corn earlier than the rest and is of a golden color. He saves the seed from this stalk, plants it by itself the next year, and awaits results. Part of the resulting corn proves to be similar to the original stalk and the rest is quite different. The grower then selects those ears which come nearest to the type that he is trying to develop and makes another planting the succeeding year, again thinning out all the ears but those which approach his type. After a few years of this selection he finds that practically all his seed comes true to type, and he can then claim to have developed a new variety. A similar process was no doubt followed in the development of all our named varieties of vegetables. As a matter of fact, there is a constant tendency on the part of a plant to change its characteristics, sometimes for the better and sometimes for the worse. This fact furnishes one reason why so many seed catalogs are continually advertising what they choose to call improved varieties. It is also one reason why individual growers who are careless about saving their own seeds, do not have much success in perpetuating varieties.

Advantage of large seed.—Recent investigations have indicated that improved yields might be expected by using only the largest and plumpest seeds of a given variety. Experiments were conducted by planting both small and large seeds

of various kinds. In every case the large seed showed a decided advantage over the small seed. Just how valuable this discovery will be in practice remains to be seen, but it is certainly worth further investigation which can easily be pursued by any one with the inclination.

Saving seed.—If the gardener expects to save his own seeds, he must select samples from those plants which have shown themselves to be true to the variety or an improvement on it. Do not let only the poorest and scrubbiest specimens remain for seed. Let the fine big heads of lettuce stand so that next year a larger percentage of the whole crop will



A simple form of seed tester.

resemble them. Do not try to gather seeds from the tag ends of the garden, but leave a few plants especially for seed production and make sure they are good plants.

Buying seed.—If the grower does not save his own seed, it must be bought from a reliable dealer. Plenty of seedsmen sell good seed, but some also sell very poor seed. As a rule, if a firm has been established in one locality for a long time and has built up a big business, its reliability can be depended upon. Some of the ordinary faults of seed dealers are that they do not keep fresh stocks, they adulterate high-priced seed

with cheap seed, and they do not exercise care to label their seeds properly on the packages. It is a known fact that several varieties of lettuce often come out of the same lot of seeds. The cost of good seed is very little more than the cost of poor seed. It is expensive economy to attempt to save on the cost of seed.

Testing seed.—All seeds should be tested before planting them. In order to have plenty of time for this work the season's supply of seeds should be ordered early in the year. The gardener can test them himself or he can have samples tested at his state experiment station free of charge. Experiment stations are equipped to examine the purity of seeds and also their germinating qualities. If germinating qualities are to be tested at home, one of the devices to secure quick sprouting of seeds is illustrated herewith. It consists of two plates, one of which is slightly smaller than the other, and a fold of cloth placed between them. The cloth is dampened, the seeds placed between the folds, and the smaller plate is used as a cover. Blotting paper may be substituted instead of the cloth. The top plate retains the moisture. Put the plates in a warm place and examine from day to day.

The "rag doll" seed tester is one of the most convenient devices for the testing of the larger garden seeds such as corn, peas or beans. It is especially valuable in the work with corn because it enables the grower to make an accurate test of each ear before planting. All that is needed is a strip of cloth, a black pencil and a water pail. Take any strip of white cloth and mark it off in squares about four inches across. Leave a strip of six inches at each end that is unmarked and allow a wide margin along each edge. Then take ten grains from each ear of corn or from each lot of seed to be tested and place these grains in a bunch on one of the squares. When all of the squares have been filled fold the edges of the cloth carefully over the seed from each side, taking care not to molest the grains or to mix them. Then very carefully roll the whole strip up and tie it securely with string. It is now

ready to be soaked in warm water for a few hours. After it has been soaked for from three to five hours it can be placed in a bucket or pail with a little water in the bottom and a cover over the top. It is well to place a stick of wood in the bottom of the pail so that the "rag doll" does not actually lay in the water. At the end of a week the tester can be carefully unrolled and each lot of seed can be examined to detrmine the percentage of germinable grains. Each square of course will represent an ear or a lot of seed and the ears or lots tested should bear numbers and the corresponding numbers should appear on the cloth.

Seeds should not be gathered until they are fully ripe, when they should be put into envelopes, properly labeled and stored in a cool, dry place.

CHAPTER III.

Spring Vegetables.

Certain spring vegetables may be planted very early in the season before danger from frost is over. This chapter is concerned only with these plants.

The spring garden.—The time for planting the spring garden must be determined by the progress of the season and by the condition of the soil. The rule is to plant the very hardy vegetables, like onions, radishes and lettuce, just as soon as the ground is in fit condition to be worked readily. A wet season will retard this planting time and a dry season will advance it sometimes considerably. No garden should be planted at any time unless it is possible to work the soil deep and pulverize it to a fine, firm seed bed.

The plants suitable for the early garden will be considered in alphabetical order and not in the order of their seasonal appearance in the garden.

Asparagus.—This vegetable is a perennial, that is, it lives in the soil from year to year. It is customary to have the asparagus bed at one side of the garden where it will not be disturbed. The plants form thick mats of roots from which heavy stalks are sent up early in the spring. These stalks are the parts to be eaten and constitute a delicate vegetable that should be in every garden.

Its culture is quite easy. It is customary to plant one-year-old roots instead of seeds in order to gain time in the preparation of the bed. These roots should be planted in rich earth at a depth of about six inches. For garden culture they may be planted in rows about three feet apart and placed

from twelve to fifteen inches apart in the row. Asparagus will not thrive in poor soil, and, if the soil is not naturally light and rich, it should be made so by the addition of an abundance of well-rotted manure. Keep down the weeds, especially during the first two seasons. Mulch with stable

Asparagus roots, showing where the shoots originate.

manure in the fall and permit the manure to remain on permanently, for it adds to the depth of the soil over the crowns as well as furnishes much needed fertility. Shoots should not be taken off during the first year and only sparingly the second year. If cut before the plants are well established, there will be a tendency to weaken the roots and cause the bed to

be unprofitable. Favorite varieties of asparagus are Conover's Collosal, Barr's Mammoth, and Reading Giant.

Beets.—While beets are not among the very early garden vegetables, they are sufficiently hardy that they should be planted soon after the ground is thoroughly warmed. Some growers even plant part of their seed before the ground is quite warm. Beets are quite easily grown. They should be planted in rows from twelve to fifteen inches apart, several inches apart in the row, and about an inch deep. By making successive plantings about a month apart, beets may be had throughout the summer. The tops are sometimes eaten as greens, but the form known as Swiss Chard is much more adapted for this purpose. Swiss Chard is a kind of beet that does not develop a fleshy root. The leaf stalk and the leaves are eaten, the former to be prepared as asparagus and the latter to be boiled and served as spinach or kale. Beets planted late in summer will

A good type of garden beet.

Swiss chard.

usually keep through the winter if gathered after cool weather sets in and stored in a dry, cool place.

Corn Salad.—This plant should be more generally known, as it furnishes a substitute for lettuce before that crop is ready for use. It may be planted in the fall of the year and protected during the winter with a light mulch of straw. It will start to grow as soon as the least warm weather approaches and will be ready for use before other vegetables. It may also be planted in early spring. In either case it should be planted in drills about a foot apart. Its culture is otherwise the same as for lettuce.

Lettuce.—A garden would not be worthy the name if it did not include its rows of lettuce. This salad vegetable may be had in a great many varieties which are suited to different purposes. Some varieties form tight heads almost like small cabbages, some are collections of large loosely curled leaves and others are a combination of the two forms.

Since lettuce is eaten green, it is necessary to force the leaves to a quick growth, thus insuring their crispness and tenderness. Accordingly the soil should be loose and rich

(12) Every garden should have its row of lettuce.

and cultivation should be very thorough. Often lettuce is planted by sowing the seed broadcast on a small plot of ground. But this method crowds the plants and prevents both perfect development and cultivation. It is a much better plan to plant the seed in rows and thin out as the plants increase in size. In this way the small plants can be used while quite young and the plants which are left will have more space in which to develop. The varieties that form heads are grown to perfection only by transplanting. The seed should be sown in a cold frame and as soon as the plants are large enough and the outside earth warm enough, the small plants can be transplanted to the permanent row. The rows should be a foot apart and the heads should be set from eight to twelve inches apart in the row. They should have constant cultivation. Plants of head lettuce may be set in any vacant space in the garden. If there is a vacancy in a row of some other vegetable use that space to set out a few heads of lettuce. They mature rapidly and can always be disposed of for some later crop. In the South, lettuce may be planted in the fall and permitted to remain in the ground over the winter. This practice is not successful in the North. The best varieties of leaf lettuce are Black Seeded Simpson and Grand Rapids. The best of the heading forms are Big Boston and All Heart.

Onions.—Onions may be grown from sets, which are merely small onions, or from seed. They require the very best cultivation if grown from seed. Those produced from the sets are used extensively for green onions eaten raw in the spring. The sets may be planted as soon as the ground is in condition to work and will grow rapidly. The seed may be sown in the open ground or it may be started in a hot bed and the seedlings transplanted after the arrival of warmer weather. Such an arrangement hastens the crop quite decidedly. When grown on a large scale the seed is sown in drills and the young seedlings thinned out so that they stand a few inches apart in the row. Frequent shallow cultivation

is essential for this crop. If the onions are grown for winter use, they should be harvested as soon as the tops are dried and stored in a cool, dry place. Distinct varieties of onion sets are difficult to obtain so they are generally sold by the color as white, red, or yellow.

The best varieties to plant from seed are the Prizetaker and the Yellow Globe Danvers.

Parsley.—This small and very ornamental plant is used as a garnish and as a flavor in soups. The seed should be sown very early in the spring in permanent rows or may be planted in a cold frame and the young plants later set out in rows a foot apart and about four inches apart in the row. When once set, the plants may remain in the ground over the winter if they are protected with a slight mulch. A few of them can be potted at a time if wanted for winter use, and brought into the house where they will continue to grow. A pot of parsley in the kitchen window is attractive as well as useful for whenever leaves are taken off, they are rapidly replaced by new ones.

Parsnip.—The seeds of this vegetable should be sown as early in the spring as possible in rows about two feet apart and the plants should be thinned so as to stand several inches apart in the row. This plant is grown for its edible roots and should be given frequent shallow cultivation. While the parsnip is included among the early spring vegetables, it is so listed merely because it must be planted early. The roots are not ready for use until late summer and are improved if permitted to remain in the ground till after the first freeze. They may even remain in the ground over the winter without injury, but they must be dug before any growth starts in the spring or they will be unfit for use. If permitted to remain neglected in the soil, they produce quantities of seed and may become a pest in the orchard.

The variety known as the Hollow Crown is perhaps the best.

Peas.—Among the first seeds to be planted in the spring

are the peas. Some varieties may be planted earlier than others. The smooth peas are, as a rule, regarded as more hardy than the wrinkled varieties, although some of the wrinkled sorts are quite hardy and of superior quality. If the ground is too heavily manured, a heavy growth of vine will be forced at the expense of the pods. Moderate fertility is to be preferred. Fertilizers rich in nitrogen are to be avoided. The rows should be three feet apart for most sorts, although the dwarf kinds, like the American Wonder, may be planted more closely. Sow the seeds so that the plants will be a few inches apart in the row. Some growers plant two rows together about six inches apart and use the same support for both rows. Where space is limited, this is a good plan. Three-foot poultry netting makes an ideal support for peas, but small brush from the woods is just as good if properly selected and firmly stuck into the ground. Peas will succeed better if planted several inches deep than if drilled with an ordinary garden drill. Some gardeners dig a trench about six inches deep and plant the peas in the bottom, covering them with two inches of dirt. As the peas appear through the surface, more soil is filled in until the trench is filled. This method causes deep rooting, thereby avoiding danger from drouth.

Sugar peas are a variety used much like green beans, the entire pod and its contents are cooked and eaten. This sort is popular in some parts of the South.

The best standard varieties are (early) Gradus, (medium) American Wonder and (late) Telephone. All varieties may be planted at intervals of a few weeks to insure a succession of crops throughout the season.

Radish.—This vegetable is one of our most hardy spring sorts and may be planted as early as any vegetable grown. In most parts of the North it may be grown all winter in hot beds and in the South it will grow all winter out of doors. In every case the radish should be planted in warm, rich soil where it will mature quickly, in order not to become tough.

Plant radishes in permanent rows about a foot apart and thin to one to two inches apart. As they grow, the largest may be pulled for use. They thus receive the desired thinning. Radishes do not thrive after hot weather starts; so it is inadvisable to attempt to plant them for successive crops. Winter radishes are planted late in August or early in September and are ready for use before frost. Some varieties are very fine and firm and with care can be stored for winter use. They are usually dug at the first indication of cold weather

Several types of radish

and either stored in a cool cellar or placed in a pile and covered with earth to a depth of two feet.

The Cardinal Globe, Icicle and Long Scarlet Short Top are some of the popular sorts. White Chinese is a good winter variety.

Spinach.—These most delicious greens may be very easily grown. The seed is planted either early in the spring or late in the fall. If planted in the fall, the plants will live over winter and furnish an abundance of greens as soon as

Victoria spinach.

growth starts in the spring. The spring-planted seed will furnish a plentiful supply of summer greens. Spinach does not succeed well in warm weather and for this reason the fall planted seed is usually more successful. The New Zealand spinach is a variety that thrives in warm weather and is recommended for planting for the summer crop.

The best variety of the ordinary spinach is the Victoria.

CHAPTER IV.

The Summer Garden.

Certain vegetables are regarded as being strictly adapted to warm weather, so an arbitrary form of dividing them into classes has been adopted. Those vegetables for the spring garden have been considered in the previous chapter and now the various plants suitable for the summer garden will be discussed.

Beans.—Any garden worthy of the name must contain some beans, and often in the country, when a good idea is carried to an extreme, a garden contains little else. There are many varieties of beans and several distinct classes, such as pole beans, kidney beans, lima beans, etc. The soil requirements for all beans does not vary to any extent. The seed should be planted in well-prepared soil which is moderately rich, and given good cultivation. Beans of all varieties are very tender, so that they should never be planted until all danger of frost is past and the ground is thoroughly warmed. Beans planted in cold, wet soil are slow to germinate and usually rot before they sprout. In planting the larger beans, when only a small quantity is to be grown, it is advisable to place each seed in the soil with the fingers, using care to place the scar on the side of the bean down. If the bean is laid on its "back," it will sprout only with great difficulty. Try planting some lima beans in a box of soil in the house in various positions and see which position furnishes the first plant above ground.

Pole beans should be planted in hills not less than three feet apart. As their name implies, they must be provided with

some sort of support. This support may be poles of any description, strings, or the stems of some other growing crop such as corn. Often certain varieties of pole beans are planted in the same hill with corn and permitted to climb the stalks.

For the small garden the bush beans are more satisfactory than the pole beans, because they do not require so much attention or need support of any kind. They form a low bush and the beans are usually produced in great abundance.

The snap beans are grown for their edible pods, although many sorts can be allowed to ripen their seeds which are then used dried. Some of the snap beans are green in color and some are yellow or white. The latter are generally called wax beans.

The following varieties are the best of their respective classes for general planting: Bush beans: Refugee, Golden Wax, Valentine. Pole beans: Kentucky Wonder, Lazy Wife, Golden Cluster. Lima beans: Burpee's Improved Bush, Fordhook Bush, Carpentaria, and Early Leviathan. The last two are tall-growing varieties.

Cabbage.—This vegetable may be grown as an early summer crop or it may be planted later and harvested late enough so that it may be stored for winter use. Early cabbage must be used promptly after the heads form or they will crack and spoil.

Cabbage seed should be planted in a hot bed, if early cabbage is desired, or in a prepared seed bed in the open ground, if it is desired to grow a crop for storage. The seed bed should be carefully worked up and the soil made very rich and fine. The seed may be sown broadcast or planted in rows a few inches apart. As soon as the young plants show above the ground they should be thinned so as to develop strong individual plants. They are allowed to remain in the seed bed or hotbed until they are ready for planting in the open ground. They should not be too large at planting time. It takes some experience to know just how early to plant the

"Kentucky Wonder" is the best green pole bean.

seed in order to have plants of the right size at the proper time. The permanent plants should be set in rows about three feet apart and about eighteen inches apart in the rows. Some growers space them farther apart than this; but in garden culture it is usually desirable to economize as much space as possible. In setting the plants in the open ground the tops must be clipped back so that the leaf surface is reduced at least half. This pruning enables the plant to become established quicker, and, if well watered at the time of planting, young cabbage plants seldom wilt. If they are not cut back, many plants will die, because the large leaf expanse gives off moisture more rapidly than the recently disturbed roots can gather it.

Some quick-acting fertilizer, such as sheep or hen manure, should be placed in each hill in order to stimulate a good vigorous growth at the start and cultivation should be constant from the time the plants are set out until they begin to form heads. If they are cultivated after the heads begin to form, a new growth might be stimulated and, as a result, the heads will split. The same effect may be expected if the cabbage is grown during a dry summer and heavy fall rains set in before the heads are harvested. Winter cabbage may be stored in a cool cellar or it may be placed in piles and covered with earth. In the latter method the plants are placed in rows with the heads down and with the roots up. The entire plant should be pulled up instead of cut off when so stored.

Danish Ball Head, Flat Dutch, and Charleston are standard varieties of merit. Savoy cabbage is a form with curled leaves and is of very good quality, but is not easily grown by the amateur.

Chinese cabbage is an entirely different vegetable, although it belongs to the same botanical family. It resembles a large bunch of celery, and, like celery, it is grown for its stalks. The leaf stalks of the Chinese cabbage are prepared for the table in the same way that ordinary cabbage is served. Its taste is similar, too, but in cooking, it lacks the familiar

A good head of early cabbage.

cabbage odor so often found objectionable. It is of the easiest culture and is grown as a distinctly late summer crop. The seed is planted about the middle of August and the plants are thinned to stand about twelve to eighteen inches apart each way. Their cultivation is similar to that of ordinary cabbage, for they must not be permitted to dry out. Chinese cabbage makes a very handsome vegetable and the ease with which it can be grown and the excellence of its table qualities should make it more generally used in this country.

Cauliflower.—The care of this vegetable is the same as the cultivation of cabbage. Everything that has been said concerning cabbage culture will apply to this crop except that it is often necessary to tie up the outer leaves of the plant in order to blanch the large flower bud in the center. This flower head forms the edible part of the plant. Dwarf Erfurt is a choice variety for home use.

Collards.—A form of the kale plant is much grown in the Southern states under the name of collards. It is planted in rows about two feet apart with the plants about two feet apart in the row. The leaves are eaten as greens.

Corn.—Sweet corn is one of the most valuable of all our summer vegetables, and it should have a place in every garden. Since it requires as little attention as any crop that can be grown, it is by no means difficult to grow. The ground for sweet corn should be rich and well prepared. If this condition is observed, any one can grow corn to perfection.

Most varieties of sweet corn are rather tender and should not be planted until all danger from frost is past, and the ground is thoroughly warmed. The seed may then be planted in rows two or three feet apart and stand from one to two feet apart in the row. Closer planting is permissible for the smaller growing kinds like Golden Bantam and for most any kinds in small gardens where space is at a premium.

As soon as the corn shows above the ground it should be well cultivated and during the season the rows should be hoed after each shower. If showers are not plentiful, it should be

cultivated occasionally in order to keep down the weeds. Successive plantings should be made at intervals of ten days to two weeks so as to have tender corn throughout the season. The later plantings can be made in the ground which was occupied by early garden crops such as radishes, lettuce and onions.

Golden Bantam is a very fine early variety that is more hardy than many other sorts and can often be planted to advantage long before other kinds could be safely started. This variety, as its name implies, is small both in stalk and in ear and the grain is golden yellow in color. The color has helped prevent its popularity on the markets; but growers generally are learning that it is one of the very best kinds to grow for home use. Undoubtedly there will be a strong market demand for this sort after the public becomes educated to its excellent flavor.

Early Adams is also a good early variety, while Stowell's Evergreen will yield an excellent main crop. Country Gentleman is a corn of fine flavor, although the grains are not arranged in regular rows, but are distributed over the cob in an irregular fashion. Mammoth Late is a good variety to grow for late summer and fall use, but, while it is large in size, it lacks much in quality when compared with the better sorts.

Cucumber.—The cucumber belongs to the same family to which the melons, squashes and gourds belong. It is a hot weather plant, so, therefore, the seed should not be planted until danger from frost is past. Like all members of the melon family, it demands good soil that has been well prepared. If not already rich, the soil must be made fertile by the liberal use of manure. The seeds should be planted in hills about six feet apart and cultivated constantly till the vines reach such size as to interfere with the work. About a dozen seeds should be planted in each hill. The young plants can then be thinned out so as to leave only two or three of the strongest vines. Thinning will preferably be done only after all danger from the striped beetle is past. If desired the young plants

can be started in the house by planting the seeds in old berry boxes or on square chunks of sod turned bottomside up. There is also a very convenient paper pot manufactured for this purpose of transplanting plants. In any case the plants are set out without disturbing the medium in which they have been started. This method results in the production of cucumbers somewhat earlier in the season than if they were planted in the open ground. A few very early cucumbers may also be grown in the hotbed by planting several seeds in the center of each bed where other early crops are growing. The cucumbers will not begin to cover much ground until the other crops are disposed of, when they can be alloted the entire space if necessary.

Melon plant started in an old tin can. The can has had the top and bottom melted off and one side has been split so as to facilitate the removal of the ball of earth.

The White Spine is one of the favorites for general cultivation, although there are many good varieties offered by seedsmen. The Boston Pickling and Chicago Pickling are widely grown for the purpose of securing the small cucumbers for use in making pickles.

Eggplant.—This vegetable belongs to the same family as the tomato. It is grown in the same way. The cultural directions for tomato will apply to the eggplant except that the seeds of the latter are to be planted earlier in the spring. The young plants are very tender, but, after they are planted out in the open ground and become established, their culture is not difficult.

Kale.—The edible part of this vegetable is the leaves, which are eaten as greens. The name is sometimes applied loosely to several members of the cabbage family, but the true

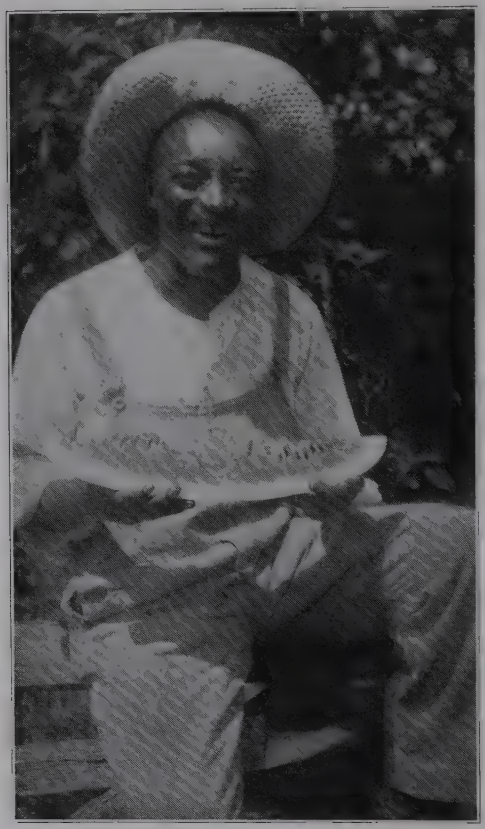
kale is a distinct plant of much merit. It is easily grown by sowing the seeds broadcast like turnip seeds during the month of August. It thrives without transplanting and will furnish an abundance of greens during the fall months. If the earth is lightly raked over the seed, germination is more satisfactory than if the seed is merely left on the surface of the ground, although in favorable seasons it will grow with no further attention. It may thus be planted among late sweet corn and will yield greens until freezing weather. By covering with a light mulch of straw, it may be kept in condition for use far into the winter. When kale is to be grown in a small space, the seeds should be planted the middle of August in shallow drills about eighteen inches apart. The plants may then be thinned to stand a foot apart in the row. This style of planting coupled with good culture will produce larger heads than the easy method first discussed.

The Scotch Curled Kale is regarded as the tenderest and best flavored of the several varieties offered.

Muskmelon.—This most delicious of all garden products should find a place in every garden except those of the far North. Like most members of its family, it requires warm weather to develop successfully. The soil should be rich and, in fact, can hardly be too rich. The culture of the plant is exactly the same as for cucumbers. If ground mice are abundant, some care must be used in planting muskmelon seed, as the mice are extremely fond of them. There is on record a five-acre field that was replanted to muskmelons three different times. The third planting was eaten just as promptly as the first ones and by that time it was too late in the season to try again. Some gardeners claim that such damage can be avoided by supplying an abundance of seed and leaving part of it on top of the ground for the use of the mice. It has been also suggested that the seeds be lightly coated with tar to make them distasteful to the mice. It is probable that a few traps and a little poisoned seed might be useful in a field that was previously known to be infested with mice. In

harvesting muskmelons they should remain on the vine until the stem separates readily from the melon. When grown for market they are always to be gathered before they are fully ripe. This fact constitutes another good reason for growing muskmelons in one's garden instead of buying those that were picked green.

Watermelons.—These melons are grown in exactly the same manner as cucumbers and muskmelons except that the vines require somewhat more space. All directions concerning the culture of muskmelon will apply also to this splendid fruit.



There is no doubt but that the watermelon is a splendid "fruit."

The following varieties are good: Sweet Heart, Watson, Iceberg, and Rattlesnake.

New Zealand Spinach.—This form of spinach is suitable for hot weather culture. The seed is to be planted in May after no more frosts are to be expected and will furnish an abundance of excellent greens during the hot months. Otherwise its culture is similar to that of the ordinary spinach.

Okra.—As this is a southern plant it is not as well known in the North as it should be.

A commercial melon field.

In the South it is a staple article of food and is served in several ways, but chiefly in soups. The tender green seed pods are the parts to be used. The seed is planted in rows about eighteen inches apart, with the plants about six inches apart in the row. As the young plants are tender, the seed should not be planted until the earth is warm. Good cultivation will assure an abundant crop. The seed pods must be used before they become too hard, when they are unfit for food. The flower is large and quite showy, so the plant is sometimes grown for its ornamental effect.

The varieties known as Long Green and Perkins are best.

Peppers.—Peppers are used mostly in pickling. Their cultural directions are the same as for tomatoes.

Potatoes.—Most average gardens do not boast of sufficient acreage for growing potatoes so they are hardly to be classed as a garden crop. They will be discussed in detail in the chapter on special crops.

Squashes.—The care of squashes is the same as for cucumbers and the other members of the family already mentioned. For serving they are baked, or cooked for pies like pumpkin.

The White Bush Squash is a summer sort that is easily grown and exceedingly prolific. The vines grow somewhat in the shape of a bush, occupying but little space. They may be planted three or four feet apart. The Hubbard is a very fine black-shelled variety that is grown largely for market. This variety requires a long, warm season in which to mature its fruit properly and after which they can be safely stored all winter. The Cushaw or crook necked squash is a favorite in the South, where it is universally grown. Directions for its culture are the same as just described.

Sweet Potatoes.—In the South sweet potatoes are a common garden crop and in favorable sections are extensively raised as a field crop. They are easily grown on any light soil. The tubers of the previous season are planted in a hotbed in

the early spring, and, as the green shoots appear, they are pulled from the parent potato and used as sets for the garden planting. These sweet potato plants are merely sprouts from the old tuber and they are produced in large numbers. They should be planted to a depth of several inches, and, as the season advances, the soil should be drawn toward the rows so that ultimately the plants will stand on the top of a slight ridge. If there has been a shortage of plants for the earliest setting, more can be obtained by cutting off the tips of the growing vines as soon as they are well started. These tips should be about a foot long, and are to be used in the same way as the sprouts produced from the tubers in the hotbeds. This method is, of course, of value only in sections having a long season and would perhaps be useless in the North owing to the fact that the plants set late would not have time to ripen their crop before frost. As a rule, the plants are left undisturbed from the time the vines cover the ground until frost. At the first slight frost the vines are likely to be killed. The potatoes should then be dug and removed to a dry frost-proof storage room. They are often successfully stored in dry sand; but under ordinary conditions they are somewhat difficult to keep without rotting.

Tomatoes will be considered under a separate chapter on special crops.

Turnips.—These vegetables are usually planted on ground that was occupied by another crop earlier in the season. They may be planted in rows ten inches apart or they may be sown broadcast over the soil to take care of themselves. The latter method is most widely used and produces very good results. The turnip is such a hardy, vigorous vegetable that it requires but little attention after the seed is planted. If the ground has been planted to other crops during the summer, it should be fairly free from weeds and the soil should be loose. Otherwise the ground must be especially prepared in the same way advised for the preparation of the spring garden. Then the

seed may be scattered over the surface and afterward lightly covered with a rake. If, after this preparation, the gardener can be favored with a good shower to start the seed, he may rest assured that he will harvest a crop of turnips. Perhaps the assurance that they require so little attention is the main reason that turnips are so universally grown.

CHAPTER V.

SOCIAL CUSTOMS AND CEREMONIES AMONG THE NATIVES.

Visiting customs.—Many questions must be asked and answered before a stranger can be received into the native society. The natives have a great deal of time to spend in conversation, and the ceremonies connected with visiting and receiving visitors are very elaborate. Everything must be done in the most methodical manner. Directly after breakfast the women begin to prepare themselves for the visit. Their hair is combed and dressed in a most elaborate style, and they put on their best clothes. Then they sit down in the verandah of the house and wait for the visitors to arrive. The women are very particular about their appearance, and they usually wear their best clothes when they are receiving visitors. Sometimes a party of a dozen or more will arrive at the house, and then the hostess has a busy time of it. She has to see that all the visitors are properly received, and that they are all supplied with food and drink. There are many customs to be remembered in this respect, and they differ greatly in the various districts.

Eating customs.—The first point to remember is that a native will not eat food which has been touched by a woman. If it is impossible to get a man to cook for him, he will cook his own food. Some natives prefer to have their food cooked by a man, and others do not mind who cooks it. The method of preparing food is very simple. The native will kill a fowl, pluck the feathers off, and then put it on the fire to cook. The vegetables are usually cooked in the same way. Some natives have ovens in which they can cook their food properly, but others do not trouble to do this. The vegetables are usually boiled in a pot. Some natives will not eat fish, and others will eat it only when it is cooked in a certain way. Some natives will not eat eggs, and others will eat them only when they are cooked. Natives have a great dislike to eating food which has been touched by a white man, and they will always refuse to eat food which has been cooked in a dirty pot. Natives are very fond of tea and sugar, and they will drink a large quantity of tea when they can get it. They are also very fond of tobacco, and they will smoke all day long if they can get it. Natives are very fond of fish, and they will eat it raw or cooked. They are also very fond of eggs, and they will eat them raw or cooked. They are also very fond of milk, and they will drink it raw or cooked. They are also very fond of butter, and they will eat it raw or cooked. They are also very fond of cheese, and they will eat it raw or cooked. They are also very fond of meat, and they will eat it raw or cooked. They are also very fond of vegetables, and they will eat them raw or cooked. They are also very fond of fruit, and they will eat it raw or cooked. They are also very fond of nuts, and they will eat them raw or cooked. They are also very fond of honey, and they will eat it raw or cooked. They are also very fond of sugar, and they will eat it raw or cooked. They are also very fond of salt, and they will eat it raw or cooked. They are also very fond of pepper, and they will eat it raw or cooked. They are also very fond of spices, and they will eat them raw or cooked. They are also very fond of herbs, and they will eat them raw or cooked. They are also very fond of roots, and they will eat them raw or cooked. They are also very fond of bark, and they will eat it raw or cooked. They are also very fond of leaves, and they will eat them raw or cooked. They are also very fond of flowers, and they will eat them raw or cooked. They are also very fond of seeds, and they will eat them raw or cooked. They are also very fond of grain, and they will eat it raw or cooked. They are also very fond of rice, and they will eat it raw or cooked. They are also very fond of maize, and they will eat it raw or cooked. They are also very fond of millet, and they will eat it raw or cooked. They are also very fond of barley, and they will eat it raw or cooked. They are also very fond of oats, and they will eat them raw or cooked. They are also very fond of wheat, and they will eat it raw or cooked. They are also very fond of rye, and they will eat it raw or cooked. They are also very fond of buckwheat, and they will eat it raw or cooked. They are also very fond of peas, and they will eat them raw or cooked. They are also very fond of beans, and they will eat them raw or cooked. They are also very fond of lentils, and they will eat them raw or cooked. They are also very fond of vetches, and they will eat them raw or cooked. They are also very fond of clover, and they will eat it raw or cooked. They are also very fond of grass, and they will eat it raw or cooked. They are also very fond of hay, and they will eat it raw or cooked. They are also very fond of straw, and they will eat it raw or cooked. They are also very fond of chaff, and they will eat it raw or cooked. They are also very fond of bran, and they will eat it raw or cooked. They are also very fond of meal, and they will eat it raw or cooked. They are also very fond of flour, and they will eat it raw or cooked. They are also very fond of bread, and they will eat it raw or cooked. They are also very fond of cake, and they will eat it raw or cooked. They are also very fond of pastry, and they will eat it raw or cooked. They are also very fond of pudding, and they will eat it raw or cooked. They are also very fond of jam, and they will eat it raw or cooked. They are also very fond of jelly, and they will eat it raw or cooked. They are also very fond of marmalade, and they will eat it raw or cooked. They are also very fond of preserves, and they will eat them raw or cooked. They are also very fond of pickles, and they will eat them raw or cooked. They are also very fond of sauces, and they will eat them raw or cooked. They are also very fond of gravies, and they will eat them raw or cooked. They are also very fond of soups, and they will eat them raw or cooked. They are also very fond of broths, and they will eat them raw or cooked. They are also very fond of stews, and they will eat them raw or cooked. They are also very fond of hashes, and they will eat them raw or cooked. They are also very fond of mince, and they will eat it raw or cooked. They are also very fond of sausages, and they will eat them raw or cooked. They are also very fond of meat pies, and they will eat them raw or cooked. They are also very fond of pies, and they will eat them raw or cooked. They are also very fond of tarts, and they will eat them raw or cooked. They are also very fond of puddings, and they will eat them raw or cooked. They are also very fond of custards, and they will eat them raw or cooked. They are also very fond of creams, and they will eat them raw or cooked. They are also very fond of ices, and they will eat them raw or cooked. They are also very fond of sherbets, and they will eat them raw or cooked. They are also very fond of lemonades, and they will eat them raw or cooked. They are also very fond of wines, and they will eat them raw or cooked. They are also very fond of spirits, and they will eat them raw or cooked. They are also very fond of beer, and they will eat it raw or cooked. They are also very fond of cider, and they will eat it raw or cooked. They are also very fond of perry, and they will eat it raw or cooked. They are also very fond of mead, and they will eat it raw or cooked. They are also very fond of metheglin, and they will eat it raw or cooked. They are also very fond of hydromel, and they will eat it raw or cooked. They are also very fond of ale, and they will eat it raw or cooked. They are also very fond of porter, and they will eat it raw or cooked. They are also very fond of stout, and they will eat it raw or cooked. They are also very fond of lager, and they will eat it raw or cooked. They are also very fond of bock, and they will eat it raw or cooked. They are also very fond of pilsener, and they will eat it raw or cooked. They are also very fond of munich, and they will eat it raw or cooked. They are also very fond of vienna, and they will eat it raw or cooked. They are also very fond of bavarian, and they will eat it raw or cooked. They are also very fond of bohemian, and they will eat it raw or cooked. They are also very fond of austrian, and they will eat it raw or cooked. They are also very fond of hungarian, and they will eat it raw or cooked. They are also very fond of russian, and they will eat it raw or cooked. They are also very fond of polish, and they will eat it raw or cooked. They are also very fond of german, and they will eat it raw or cooked. They are also very fond of french, and they will eat it raw or cooked. They are also very fond of spanish, and they will eat it raw or cooked. They are also very fond of italian, and they will eat it raw or cooked. They are also very fond of portuguese, and they will eat it raw or cooked. They are also very fond of greek, and they will eat it raw or cooked. They are also very fond of turkish, and they will eat it raw or cooked. They are also very fond of arabian, and they will eat it raw or cooked. They are also very fond of persian, and they will eat it raw or cooked. They are also very fond of indian, and they will eat it raw or cooked. They are also very fond of chinese, and they will eat it raw or cooked. They are also very fond of japanese, and they will eat it raw or cooked. They are also very fond of malay, and they will eat it raw or cooked. They are also very fond of javanese, and they will eat it raw or cooked. They are also very fond of sumatran, and they will eat it raw or cooked. They are also very fond of borneo, and they will eat it raw or cooked. They are also very fond of celebes, and they will eat it raw or cooked. They are also very fond of philippine, and they will eat it raw or cooked. They are also very fond of australian, and they will eat it raw or cooked. They are also very fond of new zealand, and they will eat it raw or cooked. They are also very fond of fijian, and they will eat it raw or cooked. They are also very fond of tongan, and they will eat it raw or cooked. They are also very fond of samoan, and they will eat it raw or cooked. They are also very fond of hawaiian, and they will eat it raw or cooked. They are also very fond of tahitian, and they will eat it raw or cooked. They are also very fond of marquesan, and they will eat it raw or cooked. They are also very fond of easter island, and they will eat it raw or cooked. They are also very fond of pitcairn, and they will eat it raw or cooked. They are also very fond of norfolk, and they will eat it raw or cooked. They are also very fond of lord howe, and they will eat it raw or cooked. They are also very fond of new caledonian, and they will eat it raw or cooked. They are also very fond of loyalty, and they will eat it raw or cooked. They are also very fond of new hebridean, and they will eat it raw or cooked. They are also very fond of solomon, and they will eat it raw or cooked. They are also very fond of santa cruz, and they will eat it raw or cooked. They are also very fond of admiralty, and they will eat it raw or cooked. They are also very fond of new britain, and they will eat it raw or cooked. They are also very fond of new ireland, and they will eat it raw or cooked. They are also very fond of new guinean, and they will eat it raw or cooked. They are also very fond of papuan, and they will eat it raw or cooked. They are also very fond of torres strait, and they will eat it raw or cooked. They are also very fond of australian, and they will eat it raw or cooked. They are also very fond of new zealand, and they will eat it raw or cooked. They are also very fond of fijian, and they will eat it raw or cooked. They are also very fond of tongan, and they will eat it raw or cooked. They are also very fond of samoan, and they will eat it raw or cooked. They are also very fond of hawaiian, and they will eat it raw or cooked. They are also very fond of tahitian, and they will eat it raw or cooked. They are also very fond of marquesan, and they will eat it raw or cooked. They are also very fond of easter island, and they will eat it raw or cooked. They are also very fond of pitcairn, and they will eat it raw or cooked. They are also very fond of norfolk, and they will eat it raw or cooked. They are also very fond of lord howe, and they will eat it raw or cooked. They are also very fond of new caledonian, and they will eat it raw or cooked. They are also very fond of loyalty, and they will eat it raw or cooked. They are also very fond of new hebridean, and they will eat it raw or cooked. They are also very fond of solomon, and they will eat it raw or cooked. They are also very fond of santa cruz, and they will eat it raw or cooked. They are also very fond of admiralty, and they will eat it raw or cooked. They are also very fond of new britain, and they will eat it raw or cooked. They are also very fond of new ireland, and they will eat it raw or cooked. They are also very fond of new guinean, and they will eat it raw or cooked. They are also very fond of papuan, and they will eat it raw or cooked. They are also very fond of torres strait, and they will eat it raw or cooked.

in spite of the great distance to be transported; but this produce also is sold at a time when no similar vegetables are obtainable in the East.

Soils.—The question of soils is important in connection with commercial gardening. Almost any farm contains a small plot of ground sufficiently rich for a successful garden; but, if the entire farm were utilized for gardening, the quality of the soil would probably fall far short of expected standards for growing a profitable crop.

The previous experience of the grower will also have much influence with the measure of success which the business of trucking may bring. Most successful commercial gardeners are men who have had long experience in the business and who have gradually extended their plantings of certain crops from year to year until they became proficient in handling the large area of some one commodity to the best of their ability. Many of the most successful market gardeners in this country are foreign born. The fact has been mentioned before that gardening in Europe and in Asia is much more efficiently done than in this country, but this statement does not infer that Americans do not make good gardeners. Until this time the massing of our population has not been crowded enough to force excellence in this branch of agricultural work. Gardening in any form constitutes hard labor. The American farmer finds it easier to devote his time to such crops as corn and small grains than to develop a backache over a truck farm. Conditions have arisen, however, that are causing American farmers to turn their attention to market gardening and, of course, our Americans will ultimately make as good gardeners as they are general farmers.

Sometimes a lack of capital will cause failure in truck growing. This kind of farming requires more labor, more men employed and more money for handling the crop than any other branch of our agricultural activity. Consequently those who enter into the business with small means may find that

they are unable to grow and harvest a crop which they planted with the highest hopes.

Canning crops.—Probably the simplest form of market gardening is the growing of special crops for canning factories. Strictly speaking, this work can hardly be called market gardening, because it is restricted to certain specified crops that are capable of being preserved in cans. Among these are tomatoes, corn, beans, peas, and, to a lesser extent, spinach, pumpkins, etc. In growing such crops it is customary to sell the entire yield to the canning factory before the seeds are planted. That is, the grower makes a contract to supply the factory with the entire product from a certain acreage at an agreed price. A contract of this sort should be so drawn that it will protect both the grower and the factory, and in filling the contract the grower should exercise care not to violate a clause or phrase which might render the contract void. If he agrees to deliver the entire marketable crop from a given area, he should be sure that this crop really is delivered and that no shortage in the measurement of the land exists. Sometimes a grower is tempted to sell a portion of such a crop to another cannery at a higher price, only to find that he has broken his contract thereby and so can not compel the factory management to live up to its side of the bargain. Most of the crops grown for canning are of fairly easy culture and for the most part they do not require the soil, care or capital necessary for the smaller crops. Some of these crops will be mentioned in detail later.

"Home Hampers."—On Long Island a method of marketing produce direct to the consumer has been developed. This "Home Hamper" system involves the use of a kind of crate or hamper in which are packed an assortment of fresh vegetables. The collection is planned to supply families of different sizes and contents vary as the season changes. The hampers are shipped direct from the farm to the consumer, the vegetables arrive clean and fresh and the city customer pays less for his garden truck than if he had bought it from the local market

or grocer. On the other hand, by eliminating a middleman the producer is enabled to realize more for his produce than if he sold it through a commission house. The plan has been such a pronounced success that it is worth trying in any locality where vegetables are produced in commercial quantities. Such a system of marketing, of course, necessitates the production of a complete list of vegetables and small fruits, so that the individual grower has no opportunity to specialize in any one crop.

It should be kept in mind that gardening on a large scale is not different from family gardening in method. All the care necessary in the small garden is also demanded in commercial planting. This occupation means much physical labor, which can, however, usually be made lighter by the use of drills, horse cultivators and other special farm machinery adapted to this particular branch of agriculture.

Tomatoes.—Among the most important vegetables that are grown commercially are tomatoes. Until comparatively recent years this attractive and valuable fruit was regarded as unfit for food and was grown only for ornament in gardens. This old-time prejudice has been completely overcome, till today the tomato, either fresh or canned, is known everywhere and is increasing in popularity each year. Thousands of acres are grown annually for the exclusive use of canning factories, while the product of other thousands of acres is shipped to the market for immediate use. The demand for tomatoes seems to be growing constantly each year.

Growing the plants.—Tomato seed is sown very early in the spring in specially prepared beds in the open ground, in hotbeds or cold frames, or in boxes in the house. The earlier the plants are started, the better are the prospects for an early crop of ripe fruit. For the most part the canning factories prefer to have their tomatoes delivered later in the season after other crops have been canned. On this account tomatoes that are intended for the canning factory are frequently grown from seed planted in beds in the open ground. Regardless of

where the seed is started, the soil must be rich so as to give the young plants sufficient nourishment for a sturdy growth.

Transplanting.—When they have thrown out one or two permanent leaves, they should be transplanted so that they stand not closer than three inches apart. Some growers transplant a second time, claiming that they thereby secure an additional yield that more than pays for the cost of growing the plants. A few growers even advocate the method of planting the seeds in paper bands placed in the hotbed. These bands take the place of small flower pots and serve to hold the soil about the roots when the time comes to set the plants in the field. While this system may seem a rather elaborate practice for a commercial grower, its value has been proven in some cases. The amount of work involved by this method is so great as to make it prohibitive for most commercial growers, but it is doubtless a good plan to follow in setting only a small patch.

Setting the plants.—The plants are set in permanent ground as soon as danger from frost is past. In the latitude of central Illinois tomato plants should be in the field not later than May twentieth. Danger from frost is over in that locality by the tenth of May and an interval of ten days is available in which to do the planting. For home use a few plants may be set out as soon as the ground is warm and the plants large enough to be set out. If cold weather should follow, they may be protected by placing some temporary shelter over them. Fruit jars make good covers, or any one of several patent plant protectors may be purchased. One or two layers of newspaper placed over tender plants in the early spring will often save them when frost is threatening. As a rule, it does not pay to attempt to grow early tomatoes in the North, because the southern crop is available long before the earliest grown northern fruits can be marketed. The commercial grower in the North will meet with more success if he confines his attempts to the main crop, which, as a rule, is marketed after the southern crop is exhausted.

Cultivating and fertilizing.—The plants are set in the field four feet apart each way and they should be in checked rows so as to enable cultivation in both directions. No crop responds more readily to cultivation than the tomato and without cultivation it is a commercial failure. The fields should be cultivated from six to eight times during the growing season, with a frequent hoeing by hand to kill whatever weeds were missed by the cultivator. Good stable manure makes an excellent fertilizer for a crop of tomatoes; but, when that is not available, it may be substituted by a commercial fertilizer containing two per cent. of nitrogen, eight to ten per cent. of available phosphoric acid and ten per cent. of potash. About five hundred pounds of such fertilizer to the acre will produce satisfactory results on average soils. After the crop has been harvested in the fall, the land should be plowed so that all remaining vines and unripe fruit are turned under. In this way injury from some of the insects and diseases attacking the tomato is prevented to a certain extent.

Varieties.—The variety known as Livingston's Stone has been a favorite for canning during the past years and remains the best sort that can be planted for this purpose. Many new varieties are introduced each year, but the sensible planter will not use new sorts until they have been thoroughly tested and their value demonstrated. The Earliana is a good variety for the home garden when early fruit is desired. Ponderosa produces a very large, but somewhat irregular fruit.

Peas are often grown in large quantities for canning factories and make a profitable crop. Frequently the ground devoted to peas can be utilized for a second crop of some other vegetable, such as potatoes or late corn. Commercially, peas are drilled in rows about six inches apart, and, when the majority of the pods are well filled out, the entire vines are cut like hay. They are hauled to the factory on hay wagons and threshed. The grower should provide for the return of the vines and empty pods, for they make good feed for animals. Before this fact was known, managers of canning factories

were often at a loss for the best means of disposing of the vines and empty pods. By accident a farmer learned that the refuse could be stored so that it would provide an excellent cattle feed. Now some factories are retaining this refuse to sell at a good price.

Sweet corn is sometimes a profitable crop either for the factory or for market. When growing it for the factory, the grower should inform himself concerning the type of corn desired by the canner and then plant the variety which is wanted. Field cultivation of sweet corn does not differ from the care of other corn, except that it is much more subject to the corn ear worm so that in some localities it must be sprayed in order to produce perfect ears. This situation will be further discussed in the chapter on insects.

Potatoes were merely mentioned in the list of garden vegetables because they are more truly a field crop than a garden crop, perhaps one of our most necessary vegetables. The following directions are intended to cover their cultivation on either a large or small scale.

Soil—Scab.—Although land for potato growing must be rich, it is not advisable to apply a dressing of manure to the potato field. Manure, as a fertilizer, will predispose the crop to the disease known as potato scab. While it does not exactly cause the scab, it will bring about proper conditions for the scab to develop. The disease is really caused by spores which remain in the ground from year to year. A field that has produced scabby potatoes should not be used again for that purpose for several seasons, as these spores live about five years. In preparing the soil it should be plowed deep and the ground well worked until it is soft and friable. If a potato planter is used, no furrowing off will be required, otherwise the ground should be marked with furrows about three feet apart and four or five inches deep. The seed potatoes are dropped in the furrow at distances of about eighteen inches and covered by hand or with a drag.

The seed potatoes should be selected from the very best

stock obtainable. Saving small potatoes for seed is poor economy as they will never produce the best results. The careful grower will select his seed in the fall when the potatoes are

The two lower specimens show poor types to select for seed. The upper is a good seed potato.

dug, choosing the largest specimens from those plants which produce large and uniform potatoes in the greatest abundance. By this method of seed selection the yield of potatoes can be very materially increased. The selected seed should be care-

fully stored during the winter. The best means of storing on the farm is by placing them on the ground, covering them with straw and then piling at least eighteen inches of good soil on top of the straw. Potatoes have been known to keep perfectly in this way through a winter when the thermometer registered thirty degrees below zero. Stored in this manner they will be in better condition for planting than if kept in a cellar, unless the cellar contains the right amount of moisture and is frost proof. To define the right amount of moisture is a difficult matter, which is even more perplexing to maintain. It is safer, therefore, to resort to the outside system of storage for seed potatoes. If stored in the ground they will not sprout so readily as in the cellar and may keep perfectly dormant until the first of June.

Cutting the seed.—In preparing the potatoes for planting they should first be cut so that there are not more than two or three eyes to each piece. However, cutting the potatoes into very small pieces is also inadvisable. It is much more preferable to have a fair-sized piece with several eyes too many than to shave the piece down to secure a given number of eyes. The potato plant will secure its start from the food that is in the piece of seed potato that is planted. If this piece is shaved down to a small quantity of food material, it will result in giving the potato vine a poor start in life and perhaps seriously affect the ultimate yield. Some growers have even planted potato peelings bought from hotels. That these peelings will produce potatoes is true, but the yield will be so light that it would more than pay to put the money in good seed.

Formalin treatment.—After the seed is cut it must be soaked for two hours in a solution consisting of one pint formalin to thirty gallons of water. This treatment is to kill the spores of scab, if any be present, and is a safe practice for all seed. After soaking, the potatoes must not be returned to the bags that previously held untreated potatoes or they may become reinfected with the disease. It is a good plan to have

a place where the potatoes may be poured out to dry, after which they should be put into containers that have been treated with the same disinfecting solution. Every precaution should be taken to be sure that only clean potatoes are planted, that is, potatoes that are free from disease. In no other way can the earth be kept free from scab, and, of course, no kind of treatment for seed put into infected land can be expected to produce a crop of clean potatoes.

Cultivation.—The potatoes should be cultivated at frequent intervals and the surface of the ground around the plants should be kept level. The level cultivation has the advantage of being cheaper, of conserving more moisture and of disturbing the root system less. After the first few cultivations some tool should be used which will not disturb the ground deeper than an inch or two. Deep cultivation is injurious to the potato, and, if the ground was properly prepared in the first place, it is not necessary. Shallow cultivation is kept up to eliminate weeds and to maintain a mulch during dry weather, thus conserving the moisture in the soil. The fine feeding roots of the potato plant spread a considerable distance through the soil, so that, if cultivation is deep, many of these roots may be cut. As a consequence, the plant is deprived of a certain amount of food and must in addition make an effort to replace the roots which were injured.

The time of planting potatoes varies with the locality and the intention of the grower. If early potatoes are desired, they must be planted as soon as the ground is warm and in fit condition to work. Potatoes for storing must be planted much later or they will ripen so early in the fall that they will not keep during winter. Sometimes, too, a crop of late potatoes will ripen early and then make a second growth, which will cause them to be misshapen. In the latitude of central Indiana late potatoes should not be planted before the middle of June and fine crops have been grown which were planted the tenth of July. In southern Indiana late potatoes may be put in after

the wheat is cut and still have time to mature a full crop before frost.

For early potatoes the Irish Cobbler, Early Ohio and Early Rose are favorites. For main crop purposes Green Mountain, Rural New Yorker, Sir Walter Raleigh, Carmen, and Duchess are grown. The Early Rose is also often planted as a late potato and can be depended upon for a full crop even if planted a considerable length of time after the other varieties are in the ground.

Potatoes are harvested either by hand digging, by plowing and hand picking or by use of one of the improved machines designed to dig and sort them. Large growers in the North prefer to use the digging machines, while in the South, where labor is cheap and plentiful, hand digging will prove more economical. Potatoes are shipped and stored either in light barrels covered with burlap or in burlap bags. The legal weight for a bushel of potatoes is sixty pounds, but there are no specially defined standard packages as there are for apples. As a result potatoes are shipped in odd sized barrels and bags.

Celery is an important field crop in some sections, but will not thrive unless planted in the type of soil demanded for its growth. It requires a rich, black soil that will not bake and in which there is an abundance of moisture. Drained swamp land, with the water table reduced to a point about two feet below the surface, is very satisfactory for this crop. On such areas in the North and in the South celery culture is carried on extensively. In the ordinary garden this crop is often unsatisfactory, but some growers meet with fair success in its culture even under seemingly adverse conditions.

For the early crop the seed is planted in well-prepared soil in hotbeds, from which the small plants are transplanted into shallow boxes. Transplanting stimulates a better root system so that the plants will more ably endure the ultimate transplanting to the field. The ground must be kept moist after the seed is planted, and one way to accomplish this detail is to cover the soil with a piece of burlap and water the ground

through it, removing the cloth as soon as the seeds germinate in order not to injure the young plants.

The plants are set in the open ground as soon as the earth is well warmed. Planting at that time will insure an early crop. In the North it is customary to grow late celery as the main crop and often seed for this yield is planted in the open ground after danger from frost is past. The treatment of the young seedlings is the same as for plants grown in hotbeds. When plants are set in the open ground, the tops should be sheared off or the leaves will evaporate moisture faster than the recently transplanted roots can secure it from the soil. If permitted to follow its own inclination celery would spread out with the leaves lying flat on the ground. To prevent this result, the soil should be worked up close to the plants in order to hold the leaves in an upright position.

Blanching.—After the plants have made their growth, they must be blanched or whitened, which may be accomplished in several ways. Some growers merely use boards along each side of the rows. Others place the celery in pits, while some sorts can be blanched by the use of the ever-ready newspaper. A few varieties, known as self-blanching, produce white stalks normally, but is not regarded as fine in flavor as the older kinds.

The culture of celery is a highly developed business to be undertaken only by those who have had previous experience with the crop. The varieties most widely grown are Giant Pascal, Boston Market and Golden Self-blanching.

CHAPTER VI.

Indoor Gardening.

INDOOR gardening is a comprehensive subject in itself, and in a book of this size little more can be accomplished than the establishment of some of the principles underlying the successful management of those crops which are grown under shelter. These principles will apply to the growing of any indoor crop, whether it be in a green house, hotbed or in a box in the kitchen window. A man, to be an expert gardener, must first be an expert in growing plants in the open, because success under shelter depends on the grower's knowledge of the needs of growing crops.

In greenhouse management two primary rules must always be kept in mind. Unless the conditions mentioned in these two rules are met, no grower can hope for any success for any crop grown under glass. The first of these is that every plant has its normal season to rest and to bloom and produce fruit. The grower must have a working knowledge of which plants to grow during a certain season so as to produce the greatest returns. Plants that are entitled to their period of rest must not be crowded into active growth. Growing plants in a greenhouse does not imply that the same plants are to be kept in a condition of active growth from one year's end to the next. They must be provided with a season during

which they may take the rest which would be accorded them if growing in a natural state. Even the plants of the tropics are not in a constantly equal stage of growth at all seasons of the year. They have periods during which they slacken their efforts and recuperate in preparation for another season of active growth.

Indoor seasons—Forcing.—By a close knowledge of the habits of the different crops, the indoor gardener can arrange his seasons so that his greenhouses will have a succession of profitable crops instead of a large quantity of idle space while some certain crop is apparently sulking. A few indoor crops are very peculiar in that they absolutely refuse to be forced into bloom ahead of their time unless given some special treatment. In an attempt to grow strawberries under glass in a small way, the plants were taken up in the fall before the ground froze, and placed in a house where carnations were growing. It was presumed that the temperature of the carnation house would be right for the berries, but the plants not only refused to bloom but even declined to grow, because they had not had their normal winter's rest. They eventually bloomed at about the same time the berries bloomed in the garden. Since then it has been discovered that this temporary resting period can be greatly shortened by using ether on the plants. In this treatment the plants are put into a tight box and subjected to the fumes of ether for several hours, after which they are potted and placed in suitable houses. Such treatment has enabled florists to force the blooms on lilacs, hawthorns, lilies-of-the-valley and other plants. The ether fumes merely take the place of the normal resting period which the plant would have if left in the open ground. Undoubtedly the same plan would have worked on the strawberry plants.

Some varieties of plants bloom at different seasons than other varieties of the same plants. Accordingly the florist must plan to have his roses of a certain kind planted so that they will produce a crop that will be available at a certain

A good carnation house.

time. If he fails to secure a crop of bloom at Christmas or at Easter when flowers are in great demand, he may lose his entire season's profit by a week's miscalculation of the proper season of growth.

Imitating outdoor conditions.—The second rule always to be kept in mind is that the weather conditions inside the house must imitate as closely as possible the weather conditions of a typical day of the growing season out of doors. Thus the florist must try to maintain in his rose house the same conditions of temperature and moisture that he would expect to find out of doors on an ideal June day. Roses out of doors are at their best during the month of June when the day temperature is relatively high, with cool nights and abundant rainfall. Many amateurs make the mistake of supposing that the day and night temperature of a greenhouse should be approximately the same. In every case the night temperature should be lower than that maintained during the day, because this is the condition of the natural air temperature out of doors in all climates; and an attempt must be made to imitate in the house the ideal out-of-door conditions. Carnations require a much lower temperature than roses, so they can not be successfully grown in the same house. The temperature of the ideal carnation house will follow closely the temperature of a typical day late in May when the thermometer does not reach above seventy degrees at any time. At night it may fall low enough to be fatal to good results with roses. Vegetable growing furnishes as many problems as flower growing under glass. Different vegetables require different weather conditions, but the principle is the same in both cases. Lettuce, for instance, is a well known cool-weather crop which succeeds best in the early spring before the days have become very warm. Grown inside, it requires similar temperatures. It will grow in a house that is suited to carnation culture, but since cool nights are really beneficial to it, lettuce can endure more cold than carnations. On the other hand, tomatoes under glass require a high temperature. They will endure as

much heat as the rose, but usually require a drier atmosphere. In this detail they conform to the rule just quoted in that they succeed best in the late summer when the normal outdoor climate is hot and rather dry.

Soil for use indoors should be selected with great care, for richness and adaptability to the particular crop to be nourished are demanded. Richness alone is not always enough to suit some particular crops. In a few favored localities soil is found exactly right for some one plant. For instance, the clay soil at Newcastle, Indiana, has proven to be exceptionally well adapted to the culture of roses, and as a consequence, a great industry devoted to this beautiful flower has been developed at that town. This soil is so well adapted to its purpose that it has been shipped great distances to other rose growers. In general, the best indoor soil is a mixture of good loam or clay loam with well rotted manure and rotted sod. Florists often make a compost pile of manure and thick sods and permit this pile to rot for a year or two before using it in the greenhouses. It pays to devote a little extra time to the preparation of the soil for use indoors in order to make every square foot as productive as possible. This advice, of course, applies to soil that is used for any sort of indoor work, whether it be greenhouse or hotbed.

Watering.—Plants grown indoors require more water than the same plants when grown outdoors. This statement is particularly true concerning greenhouses and plants kept in the living rooms of dwellings. The greenhouse beds are usually made on benches, with a circulation of air on all sides and beneath them. This condition is conducive of great evaporation and water lost from the soil must be replaced promptly and regularly. House plants demand a great deal of water because the air in the house is always too dry for the most favorable growing condition and moisture must be supplied to meet this deficiency of the atmosphere. On this account furnace-heated houses are very unsatisfactory for the growing of plants. Most farmers' wives have success with indoor

plants, because the average farm house in warmed by means of stoves, and consequently the air in the house is not as thoroughly dry as when a furnace is used. In greenhouse work it may be said that the amount of water needed, as well as expert care, is proportionate to the height of the temperature. The high temperature tends to produce a quick, rank growth which is more subject to fungous diseases and to insect attacks. The beginner in greenhouse work will do well to start with crops requiring a moderate temperature and after he has become familiar with them, he can gradually aspire to the crops needing a high temperature.

Moisture in the air.—The need of moisture in the air as well as in the soil can easily be proven by a simple experiment that can be made by any one. Take two small potted plants of any sort, but of similar size and condition. Place them in a warm, dry room where they will have plenty of light. Invert a glass fruit jar over one of the plants, and leave the other exposed to the air. Give each plant the same quantity of water daily and note the difference in growth. This experiment is especially successful with hyacinths and with some of the other Dutch bulbs. Indoor plants should always be watered in the morning and preferably on bright days. Never water plants late in the afternoon or on very cloudy days or when the temperature is falling.

Hotbeds are simply greenhouses in miniature, with another means of supplying heat than the use of steam or hot water. They are usually heated with fresh manure packed under the soil of the bed, but they may also be kept warm by building a brick flue under the frames. The popular method is to heat with manure. In preparing a hotbed the soil should be excavated from a pit slightly larger than the desired size of the bed. This pit should be about three feet deep and filled with fresh manure that has been permitted to heat once. Fresh horse manure is the best to use and it should be piled in a heap until it heats thoroughly. After heating, it is to be well stirred and mixed with from half to two-thirds its bulk

of leaves or short straw. The mixture may then be packed down into the hotbed. When in a short time it begins to heat again, it can be covered with about six inches of good soil. Hotbeds prepared in this manner should be good for about two months, and, if started the first of March, they will keep the plants in good growing condition until warm weather. The hotbed should be managed exactly like a small greenhouse and be watered and ventilated on the same principle.

The chief value of the hotbed is in the production of early vegetables and in starting some of the long season plants such as tomatoes and melons. Lettuce is a very satisfactory crop when grown in hotbeds and is largely grown under such methods of cultivation. It can be grown at either the beginning or the end of winter with perfect assurance of success. When grown in the fall it should be planted at intervals from the time of first frost until the first or middle of November in order to insure a succession of good crops. Each new planting should be made in a separate hotbed so that the last planting will have at least six weeks of strong hotbed heat to protect it from the cold weather.

Hotbed protection.—In severe weather, hotbeds should be provided with some kind of covers to furnish additional protection. The customary cover consists of a shutter made of light lumber, matting, straw mats or simply large sheets of heavy burlap. The straw mats afford the most effective shelter and can either be bought at a low price or made at home very cheaply. Make a frame the same width as that desired for the mats, which is generally determined by the length of straw available. If rye straw is used, for it is considered the best for the purpose, the mats can be made from four to four and a half feet wide. Lay the frame on two supports high enough to assure a comfortable position while at work and stretch six pieces of binder twine lengthwise of the frame. Secure the twine to nails driven at each end of the frame, in such a manner that it can be readily loosened. Then wind six balls of binder twine small enough for skillful handling,

and attach their loose ends to the nails at one end of the frame. Now lay a wisp of straw across the stretched strings, take each ball in turn and draw the string tight over the wisp of straw, bring it once around the stretched string and lay on another wisp of straw and proceed. When the mat is the size of the wooden frame, the strings may be loosened, the mat rolled up, and the strings restretched ready for another section of mat. In this way long pieces of matting may be made which will be found very convenient for covering a whole row of hotbeds. Some growers use these mats in addition to the board shutters, placing the shutters on top of the mats. This shelter keeps the straw dry, thus preventing complications in freezing weather. In late spring the glass sash can often be removed from the hotbed and be replaced by unbleached muslin. This arrangement is particularly useful in growing tomato plants, for when they are transplanted, the cloth furnishes enough shade to prevent the wilting of the plants.

Cold frames are quite similar to hotbeds except that no means of heating them is provided. They are used in early spring after the severe weather is over and their value is chiefly in protecting tender plants from late frost. A hotbed that has ceased to give out heat practically becomes a cold frame for the rest of the season. Tomatoes, cabbage and similar plants can often be started to advantage in cold frames.

House plants of some sort should be in every home, for they require so little care that there is no excuse for being without them. The chief requisites for success with plants in the home have already been mentioned, but too great stress can not be put on their need of moisture as contrasted with the usual lack of moisture in the average dwelling. Geraniums are old-time favorites for house culture because they are so easily grown and so hardy that they will grow under all sorts of adverse conditions. Various begonias and palms are perhaps next in popularity. In some places the culture of Dutch bulbs is well understood and these beautiful flowers are a con-

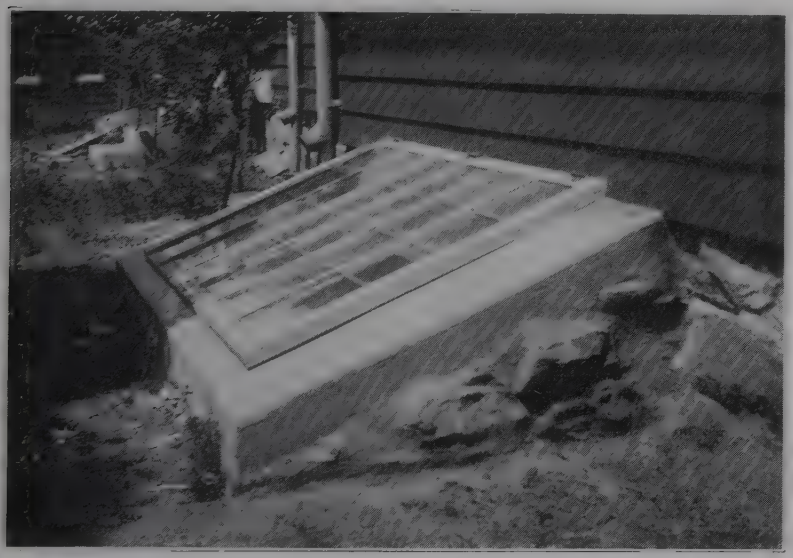
stant source of delight during the winter months. They are so easily grown that with a little care they will supply continuous bloom from December until spring. Most of the varieties of narcissus are suitable for house culture, as are hyacinths and a few of the tulips. The big yellow daffodils are such favorites that they are universally grown to supply winter cut flowers. The varieties known as Emperor, Empress, and Sir Watkin are all excellent for ordinary house culture. The pretty and reliable paper white narcissus is perhaps easiest of all the Dutch bulbs to grow. All these bulbs may be grown under the same conditions. They are produced for the most part in Holland, but more are being propagated in our country each year. When they are offered in market in the early fall, good sized, clean bulbs should be selected and planted in pots or boxes. They should be covered with about two inches of good soil and then set away in a cool, dark place for several weeks. The best success is had by placing the boxes out of doors and covering them with six inches of rich soil. This soil does not freeze readily and furnishes all the protection needed until the boxes can be brought into the house. They should be brought in as soon as the ground outside is well frozen, but before the frost penetrates to the boxes containing the bulbs. The boxes are then placed in a cool dark cellar, and as they are wanted, they are brought into the warmth and light where they bloom in the course of a few weeks.

The accompanying illustration shows a hotbed that can easily be built in the furnace room of any modern home. The bed is glazed with double glass sash and the heat is supplied from the furnace. Such a bed is not practical for the culture of roses or other greenhouse stock requiring much heat, light or moisture, as none of these elements are well supplied. It serves admirably, however, as a place to store house plants in winter and to grow Dutch bulbs, violets, parsley, etc.

Mushrooms.—In recent years much attention has been given to the growing of mushrooms for either home or market

Inside view of hot bed built out from dwelling.

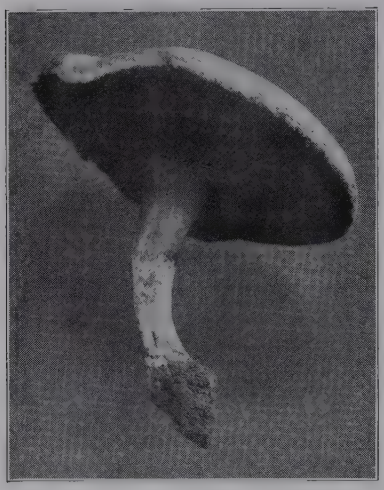
supply. The preparation of a mushroom bed is not by any means a complicated task, and, as the average farm supplies the material in abundance, there is no reason for such slight recognition of the crop. While mushrooms do not have the high food value that was once accorded them, they furnish an excellent change in the winter diet on the farm. Mushrooms are simply the fruiting bodies of a certain fungus which can



As the hot bed appears from the outside.

best be grown on fresh stable manure. The manure for this purpose should be stored in a dry place and should be forked over every day until it has ceased to heat violently, when it is ready to be packed into the mushroom bed. The location for this bed is best in a warm sheltered place where it will not be subjected to drying winds. Even moderate air currents are to be avoided. A basement under a residence often furnishes an admirable situation for a mushroom bed. A crib or box should be prepared on the floor of the cellar the size of the

bed desired. This box is then packed full of manure, which is tamped down hard and firm. It is then lightly sprinkled so as to cause it to become quite hot again in a few days. When this heat subsides and the temperature is falling, the mushroom spawn is planted in the beds. The spawn is merely a prepared form of the fungus used to start a new growth. It is purchased in the form of bricks which are to be cut into two-inch squares and planted in the bed in ten-inch intervals, about two inches below the surface of the soil. In two weeks the beds should be cased or covered with one inch of good, garden loam, in order to help retain moisture and induce the fungus to produce more mushrooms. After the spawn is put in the bed it should not be watered until after the mushrooms begin to appear, which will be from six weeks to two months. As they appear they should be gathered each day and no specimens should remain on the bed after they are large enough for use. If the beds become dry at this time, they should be watered with slightly warm water, but not soaked. After the bed has ceased to produce, the manure and soil must be removed preferably to the garden to be used as fertilizer, and the frames of the bed should be well scrubbed with white wash.



The cultivated mushroom.

CHAPTER VII.

Garden Insects.

Need for spraying.—The control of insect pests in the garden is so important that no gardener should neglect to provide means of eradicating the various pests as they appear. To fail to spray certain crops or to take other necessary measures of precaution may make all the difference between success and absolute failure. Each year garden pests seem to be more numerous and require more prompt measures of control. This same condition has been noticed in connection with orchard insects, so the conclusion is reached that the men who make provision for controlling attacks of pests will win success, while those who neglect this duty will certainly fail. Every garden should be equipped with a small sprayer and the gardener should be familiar with its use in controlling injurious insects.

Chewing insects.—One great class of insects feeds by eating the substance of the plant on which they exist. The Colorado potato beetle, commonly known as the potato bug, is an example of this class. Such feeders are controlled by the use of arsenate of lead applied in the form of a spray.

Sucking insects.—The other class of insects secures its food by sucking the juices from the plant. Food for these insects can not be poisoned because it is obtained from beneath the surface of the leaf or stalk. A good example of this class of insects is the squash bug. These sucking insects can be controlled only by some poison that kills as soon as it touches them. The best contact insecticide for use on garden crops is a solution of tobacco. This preparation may be obtained by

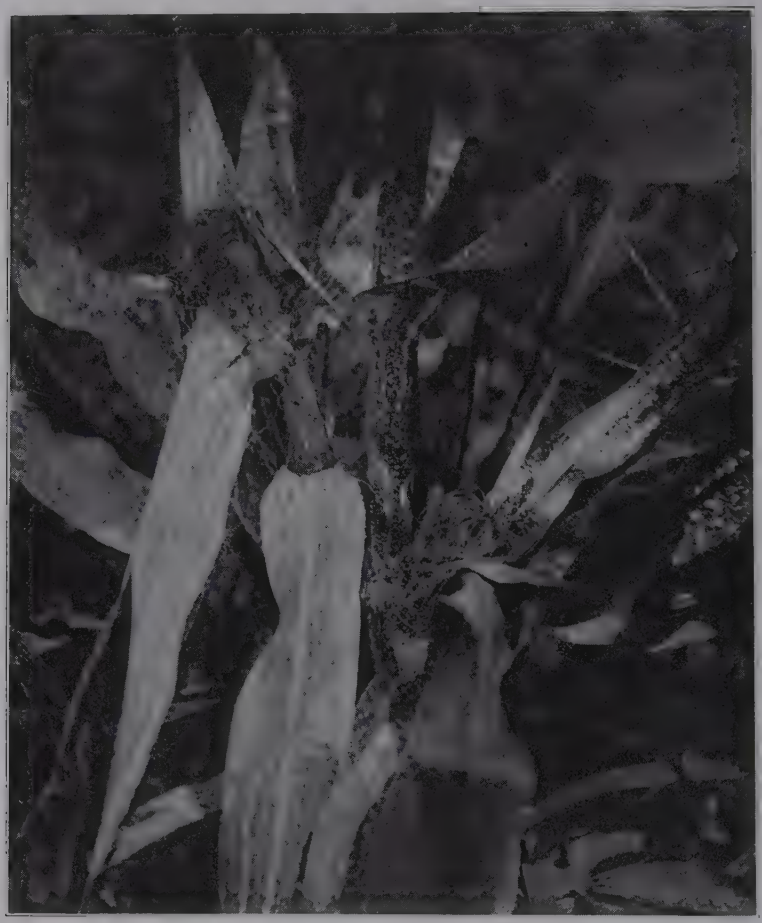
boiling tobacco stems or one of the commercial products may be purchased. Black Leaf 40 is one of the best preparations, for it contains forty per cent. of nicotine sulphate. As it is a very violent poison, it must be handled with extreme caution. In use it is diluted several hundred times according to the plant and pest that are receiving treatment.

The imported cabbage worm is well known to everyone who has tried to grow cabbage. The adult of this insect is a white butterfly, with black markings on the wings. The insect is not a native of this country, but was imported from Europe many years ago. There are also some native butterflies that lay their eggs on the cabbage, but they are not sufficiently numerous to be of any serious consequence. The butterfly lays its eggs on the young cabbage plants and from the egg hatches the familiar green worm. All the actual damage is done while the insect is in the worm or larval stage. At this stage the insect is a voracious feeder, eating the substance of the leaves and frequently eating into the heads as they form. Arsenate of lead sprayed on the plants while they are young will kill the first larvae that appear, but as the plants grow, the leaves become more waxy on the surface and the spray solution will not stick. At such times it is far better to use a poison in powder form. Arsenate of lead can now be secured in a dry state. Mix powdered arsenate with dry slacked lime and dust the compound lightly over the plants. Dry lime alone has been used with fair success, for the larva or worm is very thin skinned. Some growers have reported success in controlling the cabbage worm by the use of hot water. It would appear, however, that the objection to this measure might be in the difficulty in having the temperature of the water right to kill the pests without injury to the plants.

The corn ear worm is too well known to need any description. It is the larva of a moth that is widely distributed, but that has been more injurious in recent years than in the past. The eggs are laid on or near the tips of the ears at about the time when the silk is showing and the young larva eats its

Corn ear worm and its work.

way into the tip of the ear of corn. It is usually not satisfied to remain in that position, but must advance along the entire



Arsenate of lead sprayed in the corn when it is first showing the silk will prevent the ear worm injury.

length of the ear and ruin the entire structure. Other crops are also sometimes damaged by this pest.

Arsenate of lead applied in the form of powder at the time

the silk is showing will eradicate the ear worm in most cases. The powder should be dusted over the entire ear of corn as the insect sometimes eats its way through the husks and enters the ear at the side. Fall plowing will also tend to reduce the number of insects, for they live in the ground over the winter and the adult moths emerge in the spring.

The stalk borer is the larva of a moth which lives in the vines of the cucumber, melon and squash. The eggs are laid on the stems of these plants and when they hatch, the larva at once bores into the stalk and makes a tunnel lengthwise through the stalk. Late in the season the borers emerge from the stems, spin their cocoons, and spend the winter on or near the top of the ground. Since the insect lives and feeds on the interior of the plant, it can not be reached with any kind of poison, so that preventative measures of control must be resorted to. The presence of the borers can always be detected by the wilting of the vines and all such injured vines must be removed and burned in order to destroy the pest. This practice will also help to control the melon wilt, a bacterial disease which might be mistaken for the work of borers. A few growers have reported success by cutting out the borers as soon as any wilt appears. In this manner a vine can sometimes be saved, but the practice is not universally a success.

The common green tomato worm is the larva of the tomato sphinx moth and is widely distributed. It can be found in every garden and field where tomatoes are grown and is a close relative of the tobacco worm. The eggs are laid on the leaves of the plants on which it feeds and hatch in a few days. The larva is deep green in color, marked with oblique white stripes on the sides of the body. A spine or horn is present on the tail end of the larva which is commonly supposed to be the stinger. The insect is quite harmless, however, and the spine is provided by nature to make the inoffensive larva appear terrible to its enemies. The winter is passed in the pupa or resting stage in the ground. The accompanying cut furnishes a good illustration of the insect in its larval stage. Fall

plowing will kill many of them in the soil. If this measure should fail to keep them in check, the fields may be sprayed with arsenate of lead at the rate of three pounds to fifty gallons of water.

Tomato worm and its work.

White grubs are the larval forms of various species of June beetles, or June "bugs," as they are commonly called. For the most part the damage from these pests is done when

they are in the larval stage, although in other cases the adult beetles seem to be the offenders. The larvae eat the roots of many kinds of garden vegetables and sometimes become a serious problem to the gardener. Fall plowing, followed by pasturing hogs in the field, will be of much assistance in eliminating the pest. The use of fertilizers containing refuse tobacco is to be encouraged, for the tobacco makes the soil distasteful to the larvae. They are usually more obnoxious in a field that has been heavily manured or an old pasture field. Wire worms are the larvae of various click beetles whose life history and control resembles that of the white grub.

The striped cucumber beetle is perhaps the most serious pest with which the melon grower has to contend. It is a small yellow beetle with three black stripes running the length of the body. In this adult stage it feeds on the young melon plants and will often destroy an entire crop. It is customary to plant more seeds in each hill than are necessary in order to make allowance for the damage from this insect. Thorough and early spraying will provide the best means of extermination, however. The plants should be sprayed with arsenate of lead at the rate of three pounds to fifty gallons of water as soon as the first leaves appear above ground. They should be treated again as soon as more leaves form and the entire plant should be kept covered with the poison until the plants begin to form running vines. After that time there is little danger of injury from these beetles. Air-slacked lime, dusted on the young plants, will also serve to repel the insects, but will not kill them. Another disadvantage in using it, is its inclination to be washed off in the first rain, leaving the plants unprotected, while the arsenate of lead will stick to the leaves indefinitely.

Flea beetles are very small, active beetles that often damage garden plants early in the spring. They are especially destructive on young cabbage and tomato plants that are being grown in a prepared seed bed. If the seed bed is provided with tight board walls and covered with cheese cloth,

the insects may be excluded. In actual experiments the plants inside the protected area were not touched, while those outside were almost entirely destroyed.

The Colorado potato beetle is the most injurious insect that the potato grower has to fight. It is now universally distributed wherever potatoes are grown. The eggs are laid on the leaves almost as soon as the young plants appear above ground and the larva begins to feed as soon as it is well out of the egg shell. The insects eat the entire plant, seldom moving to another while there is still green forage on the first victim. Early in the season, when the damage first becomes noticeable, the larvae can easily be picked off by hand; but, if they are neglected for a few days, they will multiply so numerously that hand picking is not only difficult but ineffective as well. The best method of control is by spraying with arsenate of lead added to Bordeaux mixture. The Bordeaux itself is beneficial to the potato plant as it prevents leaf diseases and stimulates the plant into a more vigorous growth. The necessity for using Bordeaux on potatoes makes the control of the insect very simple, as the only expense is the cost of the poison. The application of the spray solution is indispensable, so that the expense of adding the arsenate is negligible. The Bordeaux is prepared as directed for controlling fungous diseases.

The squash bug, or "stink" bug, is a familiar insect to every farm boy. It belongs to the group of insects known as true bugs (Hemiptera, or half-winged insects). The adult is grayish brown in color and one-half to three-quarters of an inch in length. It feeds by sucking the juices of all members of the melon family, including melons, cucumbers, squashes and pumpkins. It is doubtless responsible to a great extent for the rapid spread of the melon wilt, a bacterial disease. The insect will feed on an infected plant and later on a healthy one, transferring the bacteria from one to the other. The insect is controlled by gathering the eggs by hand or by trapping the adults. The eggs are large for the size of the insect and

are laid on the under side of the leaves. They are bright yellow in color, so are not readily overlooked. The adults may be trapped by placing boards near the melon vines, under which the insects will seek shelter at night. If the boards are lifted each morning, large numbers of the beetles can be taken in this manner.

The harlequin bug is very injurious on cabbage in the South and is now found as far North as south central Indiana. The adult winters over in trash on the ground and begins to lay eggs early in the spring. The eggs hatch after a short period of incubation and the young grow with amazing rapidity. Many broods are produced each season and by fall the cabbage field may become a swarming mass of harlequin bugs. Since the insect secures its food by sucking the juices of the plant, it can not be eradicated by the use of arsenates, but must be reached by contact insecticides. Another problem is presented here because the bugs are so resistant that they will not yield to any contact poison except those strong enough to injure the cabbage plant. It has been observed that the bugs prefer mustard to cabbage and that one of the best methods for controlling them is to plant a row of mustard about and occasionally through the rows of cabbage. When the bugs have gathered on the mustard, they may be sprayed with pure coal oil. The oil will not only kill the bugs, but will also injure, if not kill outright, the mustard as well. Where this pest is established, a community should coöperate to destroy it completely. If an entire neighborhood would work together in this way, many common pests would be much more easily controlled.

Plant lice of various kinds are often encountered in the garden, and, in most cases, they can be controlled by the use of Black Leaf 40, a preparation of nicotine sulphate. The cabbage aphis lives over the winter on the old stubs left in the garden. These old roots should be removed and burnt, or plowed under deep. The corn root louse sometimes becomes a troublesome pest on sweet corn. The insect is colonized by ants, for, by itself, it is quite helpless. The ants carry the lice

about, permitting them to become established on the roots of the corn plants. The use of kainit, crude potash salt, or of nitrate of soda will discourage these pests. Fall plowing of the corn fields will also tend to check the spread of these insects, as it will result in breaking up many of the ant nests.

Kaiser Bug.—In the summer of 1917 a new aphid pest appeared in many sections of the country on potato and tomato plants. This aphid was in some sections given the name of "Kaiser bug," on account of the suddenness and insidiousness of its attack. This was a case of a previously unimportant insect suddenly becoming a dangerous pest. The insect was first described in Florida thirty-five years ago and since that time has been observed as an occasional obscure louse. Suddenly it appeared in enormous numbers and caused tremendous damage. It will yield to the usual treatment of a tobacco spray (Black Leaf 40 diluted 1 to 500), but the treatment must be very thorough and must be repeated at intervals of not more than three days. As the insect attacked not only potatoes, but many other plants as well, there were always plenty of specimens to crawl back on the vines that were cleaned by spraying. Hence the necessity for repeated spraying. This particular aphis has a tendency to "let go all holts" and fall to the ground when the plants are disturbed. As a result of this habit we have another method of control that is available to the small grower. Take a shallow pan, such as an ordinary wash basin, and put in it about an inch of kerosene. Hold the pan under the side of the infested plant, bend over the tops and give them a shake. With a little practice the gardener may treat quite a patch in a surprisingly short time. Some of the insects are sure to miss the pan and fall to the ground, but they will crawl back to the growing tips as soon as possible and the next day the treatment can be repeated. One gardener in Indianapolis who used this method kept his vines practically free from the pest, while his neighbors who were doing only indifferent spraying lost most of their crop.

CHAPTER VIII

Home Storage of Fruits and Vegetables

After a crop of fruit or vegetables has been produced for home use it will pay to use exceptional care to have it properly stored for winter. Many fresh fruits and vegetables can, of course be kept only by canning them; but that is an activity apart from the design of this book. Those crops which can be stored in a fresh state will be mentioned in detail at the end of this chapter.

There are three general methods of storing fruits and root crops out of doors as follows: Storage in pits, in surface mounds and in special cellars.

Pits are simply trenches dug in the ground at any convenient place where good drainage can be secured. The lower end of the trench should always be open so as to allow water that has run in to drain off, for no crop should be stored in a place in which water is standing. The vegetables to be stored in the pits are placed there in the fall as soon as cool weather approaches, after which the pits are covered with straw to a depth of eighteen inches. Over the straw is placed a covering of boards to shed the water. This method of storage is particularly adapted to the preservation of celery.

Surface mounds present the easiest method for storing many kinds of fruits and vegetables. The mound should be made in a portion of the garden or other place where the soil is mellow and where good drainage can be secured. The land should slope in all directions from the location of the mound.

It is usually preferable, but not necessary, to place on the ground a layer of clean straw. On this is heaped the fruit or

Turnips prepared for wintering. They are ready to be covered with earth.

vegetables to be protected. They should be arranged in the form of a rough cone and covered with straw to a depth of about six inches. If heavy paper is available it should now be

placed around the cone of straw in such a way as to shed the water and keep it from running down over and through the pile of vegetables. Paper for this purpose should be strong and water proof. Red builders' paper will answer the purpose, but tarred paper should never be used. The writer once used tarred paper to cover several barrels of apples that were stored by this method and when the fruit was removed in the spring every apple had acquired a moth ball taste that no amount of exposure to the air would remove. After the building paper has been applied over the straw, earth should be heaped upon the mound. Begin at the bottom of the mound and work completely around the pile, making a wall of earth of definite thickness and gradually build up this wall from the bottom toward the top. Do not attempt to cover the mound by throwing the earth on top of the pile and allowing it to run down the sides; always build the earth walls from the bottom. In that way you can always be sure of the thickness of the covering. Apples will not require to be deeply covered, because slight freezing does not affect them. A four- to six-inch wall of earth on top of the straw will keep apples perfectly. Potatoes, however, require much heavier covering, as do all root crops. The earth covering for potatoes should be at least as thick as the average frost depth in the locality in which the potatoes are stored. If the ground commonly freezes to a depth of twelve inches, then the earthen walls should be twelve inches thick. However, some growers avoid the use of thick coverings by applying a light cover of manure on top of the earth. By this method the thickness of the wall may be reduced at least one-half.

Apples or potatoes in barrels or boxes may be stored on the same principle as the surface mounds. Instead of building a mound of the fruit or vegetable, the boxes or barrels are merely laid on the ground with a few short pieces of timber under them to prevent actual contact with the soil. They are then covered with straw and treated in the same manner as the mounds. The use of paper in these mounds prevents the water

from leaking down over the stored product. If the mounds leak the fruit is almost sure to have a mouldy taste imparted to it by the water that has run through the soil covering.

At the door of a modern apple cellar in February. The heavy screen door can be seen in the background.

Cellar storage is by far the best method for keeping the majority of fruits or vegetables. The cellar under a dwelling may be used to keep all sort of fruits and vegetables, but, as a rule, such cellars are not adapted to this purpose and so it nearly always pays to build a separate outside cellar for this especial purpose.

Air and moisture are the two essentials to the successful storing of most fruits and vegetables and unless these two factors can be supplied in controlled quantities the cellar will never be a success. Air is needed because of the fact that all fruits or vegetables are still parts of living plants. They are actually alive and the life processes of plants are still going on in them. The skin of an apple takes in oxygen and gives off carbon dioxide gas just as the skin of an apple leaf does. If fresh air is not supplied, this carbon dioxide gas may accumulate in sufficient quantities actually to injure the fruit. It is now supposed that this action causes most of the injury known as "storage scald." The theory is further strengthened by the fact that apples that are picked slightly green, i. e., those that are still more actively engaged in doing leaf work, are much more liable to this injury than are apples that have been allowed to become fully colored, fully ripe and more or less dormant so far as their plant activity is concerned.

Moisture must be supplied in any cellar where apples are stored because of the fact that the fruit may dry out if it is kept in too dry an atmosphere. Moisture is also necessary early in the season in order to reduce the cellar temperature. If plenty of dampness is supplied to the walls and floor and an abundance of ventilation is provided, the temperature of the cellar will be greatly reduced by the evaporating moisture. In Mexico water jars are made with slightly porous walls through which a portion of the water seeps to the outside surface. These jars may be placed in the hot sun and the water will always remain cool due to the loss of heat through the rapidly evaporating moisture. It is this principle that is used in

reducing the temperature of an apple cellar in the early fall; and unless both moisture and air can be supplied in liberal quantities one of the chief objects of the cellar will be defeated.

Temperature Control.—In the early fall the temperature of storage cellars may also be reduced by opening the door at night and closing it during the day. This should be done some time in advance of the actual use of the cellar for storage so that the place may be as cool as possible when the fruit is put in.

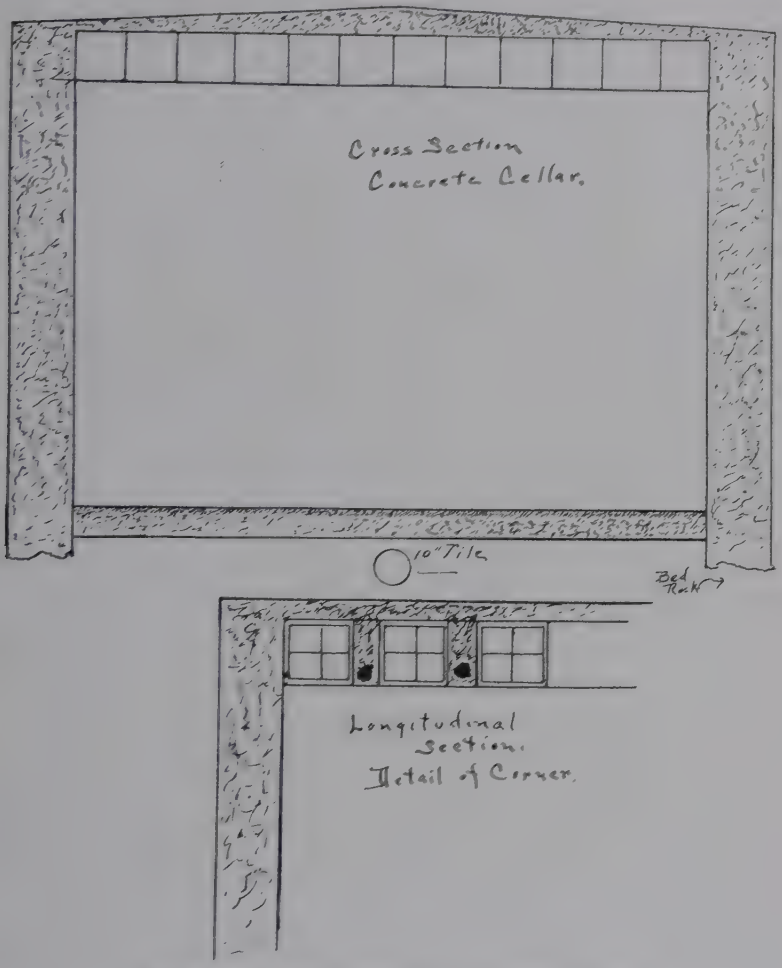
It is also advisable to place the fruit in the cellar in the morning and not in the latter part of the day. If fruit is put in the cellar late in the day it will have become warm with the sun and will accordingly tend to raise the temperature of the cellar atmosphere. Some growers leave their fruit in an open shed until the first very cool night and the next morning place it in the cellar. This pre-cooling of the fruit before placing it in storage is important enough to be given some extra care.

Material.—Storage cellars may be built of brick, stone or concrete. Stone cellars are open to the disadvantage of being accessible to mice unless the joints are very thoroughly and carefully pointed. Brick cellars are mouse and rat proof, but are not as strong and usually not as cheap as concrete cellars.

Concrete cellars should be built with walls of sufficient thickness to support the roof, as the entire weight is thrown on the side walls. The accompanying plan for a concrete cellar has been thoroughly tested and several structures have been built to the specifications mentioned. The walls are twelve inches thick and the roof is built of hollow tile twelve by twelve by twelve inches. These tiles are covered by a three-inch layer of concrete.

The wall forms are first built and then the inside form is roofed over with tight fitting boards. This wooden roof is to form the support for the tile roofing. The square tiles are laid across the cellar in courses, with a four-inch space between each course. These spaces are to form concrete beams be-

tween the rows of tile. Near the bottom of each of these beams should be placed a twisted steel bar, 1¼ inches thick, to serve for reinforcing.



Some construction details for a concrete cellar.

The floor should be of concrete and should have one or more openings connected with a ten-inch drain tile to afford

both drainage and ventilation. Most of the ventilation can be obtained through the door. In very cold weather it is necessary to shut off much of the air circulation in order to retain the proper temperature. Consequently a ten-inch drain will supply all the air that is needed when the weather is so cold that the door should be closed.

Screens must be provided over the drain tile and also over the ventilators in order to exclude mice. It is also very important to provide a heavy screen door that will close neatly. All of these screens may be made of $\frac{1}{4}$-inch mesh galvanized wire cloth, which will last for years. They form one of the important items in the construction of a successful storage cellar.

If the walls are built one foot thick they will support a roof span of fourteen feet with perfect safety. The cellar can then be built fourteen feet wide and as long as may be desired. These proportions have been found to be very satisfactory in actual practice.

Ventilators should be placed in the roof at intervals of about twenty feet. These are best built in the form of concrete flues at the time the roof is made. The concrete should extend about eighteen inches above the top of the roof and should be capped with a galvanized iron extension three feet long. This extension should have a hood and the air openings at the side should be covered with screen to prevent mice from entering.

The door need not be built unusually heavy. In some cellars it has been the practice to use heavy refrigerator doors, but a simple door made of two thicknesses of inch boards, with an air space between, will answer every purpose.

Roof.—After the concrete work is finished and before the earth is put over the cellar, the roof should be given a heavy coat of pitch, to enable it to turn the water. It is immaterial how much water comes through the walls or runs over the floor, but it is not desirable to have any leaks in the roof. Such leaks cause water to run down over the fruit and if it is stored in barrels or other packages the moisture will

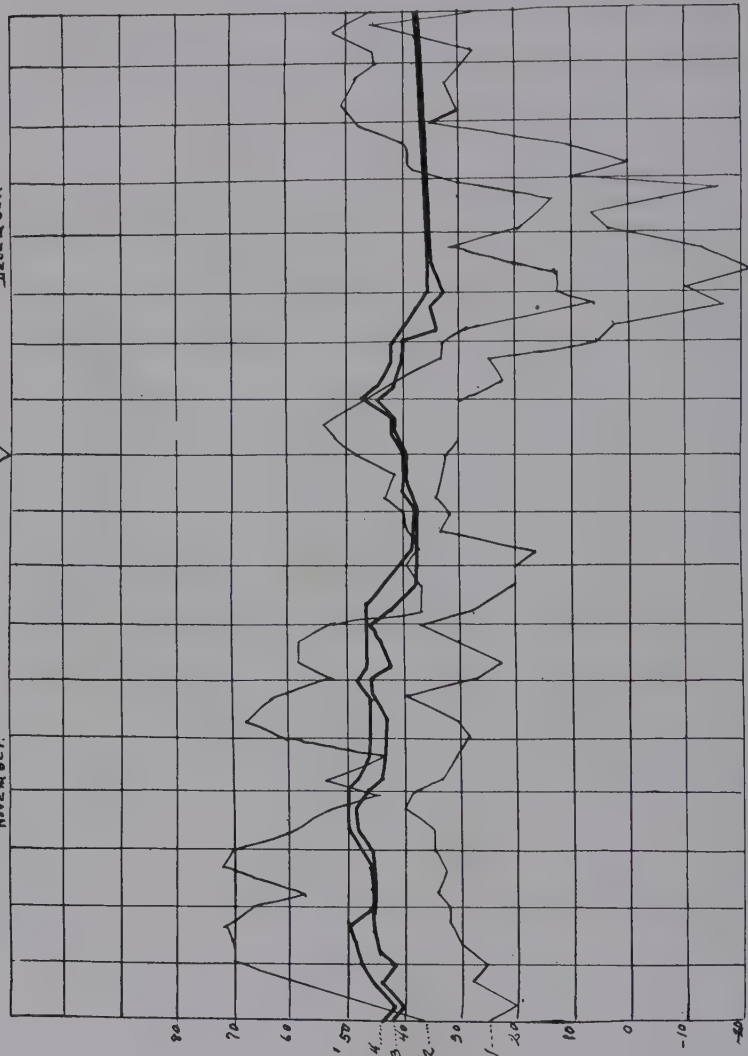
spoil the appearance of the package even if it does not injure the fruit. Where tile has been used in the roof as above described, it will not require a very heavy covering of earth to make the roof frost proof. The walls, of course, will be covered completely to a depth beyond the possible frost line. Six inches of earth on the roof has kept one of these cellars warm

Apples in a concrete cellar. This cellar is fourteen feet wide and eighty feet long.

in weather that caused the thermometer to register ten to twenty blow zero for more than a week.

The accompanying chart will give some idea of the temperature range inside one of these cellars as compared with the range outside. It is desirable to hold the temperature as near one place as possible.

The following notes on the storing of various fruits and vegetables will serve as a guide in the matter of keeping the different sorts for winter.



Temperature chart, showing the variations in temperature inside and outside of a concrete cellar during November and a part of December.

No. 1—Daily outside minimum.
No. 2—Daily outside maximum.
No. 3—Daily inside minimum.
No. 4—Daily inside maximum.

Apples.—The fruit should be well grown, have reached its full size, but not necessarily its full color. Grimes should be fairly green. Delicious must be picked while still very hard and firm. May be kept in either surface mounds or cellars, but preferably in cellars. There must be a surplus of moisture in the air or they will wilt and lose quality.

Beets may be kept in pits, mounds or in moist cellars. They should be fully grown before harvesting and should have the tops cut off about an inch or two from the root to prevent too much loss of moisture.

Cabbage.—Store in pits or mounds. Cellar storage is not uniformly successful. A common method is to pile the heads in a long "rick," with the roots sticking up. (For storing in this way the plants should be pulled root and all.) Then cover the rick with earth just heavily enough that the roots stick out of the ground.

Carrots.—Store in mounds or in a cellar having plenty of moisture.

Celery.—This is best stored in pits. The trench should be made deep enough to receive the entire plant. Plants are transplanted to these pits and are packed in them just as closely as possible. The roots should be well covered with earth in order to maintain an abundant supply of moisture to the stalks.

Onions should be gathered during a dry time and should not be allowed to become moist or they will rot. They can best be stored in a dry room where they will be free from frost. Some varieties are not injured by freezing if they are allowed to thaw out slowly, but the safest plan is to keep them from freezing.

Parsnips may be dug in the fall and stored in pits, mounds or in moist cellars. However, many growers allow them to remain in the ground over winter. They are perfectly hardy and withstand freezing. The flavor is improved after they have been frozen so that even though they are to be stored they should not be dug until after a severe freeze.

Pears.—Some of the very late varieties of pears may be

kept in storage until January or February. Each fruit should be wrapped in paper and handled carefully. They require less moisture than apples and can often be stored to advantage in a cellar under a house that would be entirely unsuited for apples.

Potatoes.—This is one crop that is not in the least particular about the way in which it is stored. If the tubers are kept from frost and at the same time not permitted to get too warm they will remain in good condition. Cellar storage such as is adapted to the keeping of apples will also hold potatoes in perfect condition. They also endure both more and less moisture than will apples. They can be kept out doors in mounds if protected from freezing and do well in an ordinary house cellar. If the air is too dry they are inclined to wilt and if it is too warm they may sprout. Potatoes stored on the farm by any of these methods make much better seed potatoes than do those which have been kept in chemical cold storage.

Sweet Potatoes.—Unlike Irish potatoes, these must be stored in a warm, dry place. They may be packed in dry sand and kept in a house cellar. They are difficult to retain in good condition.

Turnips should be pulled in the fall after cool weather sets in. They will withstand some freezing weather in the field. They are best stored either in mounds or in a moist cellar. If stored in a mound they should be as well protected from freezing as potatoes. Although they are not injured by rather cold weather while they are standing in the field, they are soon ruined if allowed to freeze after they have been gathered.

CHAPTER IX

The Back Yard Garden

In an earlier chapter the fact has been mentioned that in all large cities, and in many small towns, a great waste of good land exists through the premature "laying out" of additions to the town. At the edges of all of our towns and cities, more vacant lots are often found than lots on which are houses. This land, often in small parcels, produces as a rule only a crop of weeds—a crop that must be harvested by being cut down, but which produces nothing of value to the community. The majority of our American homes also have in the rear of the house a space of considerable extent designated as the "back yard". Too often the back yards are an expense, when, as a matter of fact, they should be an asset. The recent high prices and general shortage of all sorts of food stuffs has caused a more or less systematic movement throughout the land involving the cultivation of these vacant spaces in our towns. "Patriotic gardens" have sprung up in the most out-of-the-way places and have been tended by people who had previously never thought of themselves as possible agriculturists.

This movement has been so enthusiastically received by such large numbers of the population that it seems advisable to devote one chapter particularly to the city gardens in order that some of the difficulties beginners experience in this new field may be removed.

Patriotic gardens are an innovation in America, but they have come to stay. (This is written during the winter of 1917-1918.) I recently heard a woman in one of our large cities remark that she "hoped the war would be over before spring so

that they would not have to bother with a garden again." As a matter of fact, if the war was already over our patriotic gardens would be an economic necessity for several years to come. It will require a number of years for the world to get its balance again after hostilities have ceased and by that time our city people will be so enamoured of their gardens that they

A city garden of a foreign-born citizen. The surplus from this garden is sold to a local grocery.

will continue them for the enjoyment in the work if for no other reason. The joy of seeing things grow is one of the gardener's rewards. It is not necessary to make "two blades of grass grow where one grew before," but it is quite important to produce something of value where nothing at all had ever been produced.

Some people have tried to minimize the value of the city garden and to intimate that the general adoption of gardening in the city would never be a success, but the results of the past year have proved that quite the contrary is true. Many city gardens failed, but many more were a success and as the years go on the percentage of successes will grow amazingly.

A city friend of mine sent me his list of seeds that he had selected for his first attempt at back yard gardening. He had

Even the leaf lettuce will form rather compact heads if it is transplanted and given plenty of food and room.

a large yard, but the list which he presented was large for even such an extensive garden as I have in the country. I discour-

THE BOSTON LETTUCE

aged him about planting so many different things, but he finally made it clear to me that he wanted my advice only in regard to the varieties he had selected and that he expected to

grow everything that he had listed. Late that summer I had the pleasure of seeing his "plantation" and I was truly surprised at the measure of success he had attained. He had grown everything from radishes to watermelons and had had some of nearly every crop to give to his neighbors. This was before the popular movement toward city gardens and the same man has repeatedly equaled his first success. During the past year he produced, in addition to his usual summer crops, nearly enough potatoes to supply his family throughout the winter.

Such a case might seem exceptional, but, as a matter of fact, is not. The school gardens that were started last year in most, if not all, cities proved beyond a doubt that the waste land in our back yards can be made to produce a very considerable amount of food. However, the idea of the school garden is not a new one. In many localities such gardens have been long estalished and they have produced more than food. They have taught the children who tended them, the value of labor. To some they have taught a trade; I know several young men who are now commercial gardeners who obtained their start in a city school garden. To many of these city children the gardens have brought the joy of the open air in its best and most valuable form.

Gardening in the city, however valuable and interesting it may be, has its drawbacks and disadvantages. There are more difficulties to be overcome than there are in the country—difficulties of atmosphere, soil, and experience. Most of these difficulties may be overcome by work and patience. Next to a good soil, sunlight and air are garden requisites. The air is, of course, abundantly provided and in spite of the smoke in some parts of cities it is good enough for most growing plants. Even in the factory districts and near railroad yards I have seen splendid gardens in spite of the smoke; but the sunlight is sometimes a difficult matter to secure. In small lots the houses and fences often shade too large a portion of the available land to enable the amateur gardener to make much headway, but even here changes may be made to help conditions.

Board fences may give way to fences built of woven wire and thus provide not only a strip of light, but provide at the same time a support for such things as can be trained to grow on a trellis. Along the fence, if it be of wire, is an admirable place for tomatoes. Pole beans of all sorts can also be planted along such fences and the need for poles vanishes.

Often in a back yard there is an old tree, a "loafer" tree, that produces nothing but shade and even then sheds its

A good back yard garden.

leaves early and stands as an unsightly and useless object. Such old trees should be cut down wherever they interfere with the garden. It is difficult to grow fruit in the city, much more difficult than it is to grow garden stuff; and a live garden is undoubtedly more beautiful and valuable than a half-dead tree. There will always be some places in a city yard that will be shaded. Buildings can not be removed, and sometimes owing to the contentious dispositions of neighbors wire

fences can not even be erected. In such cases we must make the best of our adverse conditions and plant in the shaded portions only such plants as we know are shade enduring. Fortunately there are such plants, about which the gardener should know in order to make the most of his opportunities.

Probably chief among vegetables that will grow in the shade is lettuce. As a matter of fact, a lettuce bed thrives better in partial shade than it does in the open sunlight, especially after the weather turns quite warm. In the country it is not an uncommon practice to plant a bed of lettuce under a tree

A school girl's city garden.

and in such situations it remains in good condition long after the open-grown lettuce has become tough and bitter. Radishes will also grow in the shade and for this purpose the small Cardinal Globe is one of the best varieties.

Spinach is another crop that could be grown in shaded areas, though it will not do as well as it would if it had full sunlight. In fact, very few plants will grow as well without plenty of sun as they will in the open, but for the purposes of this chapter a few vegetables are suggested that may be grown with a minimum of light.

An asparagus bed might well be planted in a shaded corner. I have seen some good asparagus grown on the north sides of buildings, for the nature of the asparagus foliage is such that it can make the most of the light which is available. Swiss chard is another vegetable that will endure a measure of shade without much injury. In fact, chard which is grown in partial shade is more tender than if grown in the open. The same fact is true of Chinese cabbage, one of the newer vegetables that only requires to be known to be appreciated. Chinese cabbage is always planted late in the season and could well occupy the same ground that had previously been producing lettuce and radishes. This form of cabbage, however, requires a fertile soil and plenty of moisture, so unless these can be supplied the city gardener would better not attempt its cultivation.

Keeping the rows straight.

It is with the soil that the city gardener will probably have most his troubles. Some city gardens would try the soul of a saint at spading time and probably later too.

Most cities are "built up". In an effort to bring the town to a uniform level the city fathers have rearranged the face of nature to such an extent that she would not recognize herself. The average back yard, if it is an old part of town, probably has several layers of "made dirt" whose surface soil is composed of a choice mixture of brick bats, old plaster, clay, gravel, stones and more or less decomposed

tin cans. I have delved in city yards and I have sometimes thought that my feelings were akin to those of the man who makes a business of digging up buried cities. I have found everything in back yard soils except treasure—*that* is for the man who will patiently work with such conditions and produce a crop. It is a treasure that must be planted and that will increase each year.

If a garden is attempted in one of these filled-in yards, the first thing to be done is to have the garden area spaded as deeply as possible. Somewhere below all that rubbish is a layer of soil that is probably good. In many cases it is very good. It is indeed buried treasure and will yield up gold in several forms to the patient toiler who will work for it.

It is not necessary to uncover this deep layer of good soil in order to make its fertility available for your garden plants. Loosen the soil deeply and the probabilities are that your plants will send their roots down after that long-covered fertility and bring it to the surface in flowers and fruit.

The children are always interested in what they have helped to produce.

Taking out the stones, the bricks and the tin cans is a job that embodies very little of the poetical, yet it is a job that pays good wages. These stones and bricks must be removed not only to afford root room, but to facilitate cultivation of the crop. Taking out the foreign matter means simply putting the city soil into good mechanical condition. It is no more rigorous labor than many New England farmers endured when they cleared the

forest from their hillside farms and then had to remove the stones to obtain access to the soil. Unlike the virgin hillsides of New England, however, the city soil is usually deficient in fertility in addition to being in bad physical condition. To improve the fertility and also to help the texture of the soil, a good heavy application of stable manure should be applied and thoroughly turned under. This procedure means that the soil must be worked twice. Once to remove obstructions and again to cover the manure that is applied as a fertilizer.

In the majority of cases manure is the best fertilizer that can be used in gardens whether in the city or elsewhere. Com-

Kentucky Wonder Beans grown on an otherwise useless fence.

mercial fertilizers have their value in their proper place, but never have they been able to replace advantageous use of stable manure in the growing of garden truck. After the manure has been applied and spaded under, go over the whole surface with a sharp small hoe or with a steel rake entirely pulverizing the clods not only on the surface, but as deep as the ground has been worked. Any air spaces under the roots of your plants must be prevented. Such air spaces allow the

soil to dry out and will cause the plants to perish more quickly than almost any other cause.

After the seed is planted and the young plants are appearing above the ground be sure that the surface of the soil is kept loose and well stirred. If the first preparation of the ground has been correct, cultivation need not be deep, two inches is enough, but must be done thoroughly and constantly. If the garden is watered with a hose be sure not to water too frequently. More gardens in the city are injured by too frequent watering than by not watering at all. Some gardeners have attempted to water their plants every day. As a result they have applied only a small amount of water each time—not enough to soak into the soil so as to benefit the roots, but just enough to wet the surface. When this wet surface dried a crust was formed and in that way still more soil moisture was allowed to escape. The deep moisture in the soil can get away more easily through a hard crust than through a well cultivated surface. If artificially watered let it be infrequently, but when it is done the soil must be thoroughly soaked. A garden that is well soaked once a week is always more greatly benefited than one that is just "sprinkled" every evening.

Even the city gardener must spray.

The following list of vegetables is given for city cultivation, with a few remarks applicable to city conditions.

Asparagus.—Except in unusual cases, not advised for city gardens. When the ground can not be well be used for other

purposes on account of shade or where there is plenty of room, it might prove a desirable crop.

Beans.—The bush beans are most desirable for city cultivation. The bush lima beans are good and the White Wax and Valentine are splendid. As a rule it does not pay to try to grow "navy" beans in the city, as they require too much space for the amount of food produced.

This boy specialized on lima beans.

Beets should be in every city garden, as they are easily produced and seem to thrive on many different soils. They are very hardy and so the seed may be planted early. Swiss chard, a form of beet grown for its edible leaves, is a popular vegetable. It is the most easily grown of all plants used for greens.

Cabbage.—Not as a rule advised for city cultivation, as it requires too much space. The Wakefield is undoubtedly the best cabbage for city purposes.

Carrots are easily grown. The ground should be kept loose to allow full development of the roots.

Corn.—This crop requires much space, also shades other crops near by. However, if a good variety of sweet corn is used it can be planted with some of the pole beans and the corn stalks will not only produce their crop of roasting ears, but will also provide support for the beans. A good combination of this sort is the Stowell's Evergreen corn and Kentucky Wonder beans. The very dwarf corns, like Golden Bantam, should not be planted with beans.

Real food stuff produced in a crowded part of town.

Cucumbers require less room than almost any other member of the melon family. They may be grown on a trellis or over a wire fence. As a rule, however, they are not desirable in the city garden.

Kale.—As a crop to follow early vegetables, kale will produce considerable food. It can be planted in the space formerly occupied by lettuce, radish and beets.

Lettuce.—By all means every city garden should have its bed of lettuce. Although it is possible to buy fine head lettuce in the markets nearly every day in the year, the city man should know the quality of really fresh lettuce. It is quite different from the quality of lettuce that has been shipped across the continent or stored by the dealer for several days. Big Boston is a good variety for the beginner.

Onions from sets can be grown readily and a small area will furnish enough to supply the average family.

Parsnip.—The parsnip can be grown in most soils, but the grower must have patience with the seed after it is planted. Germination does not take place very promptly and most beginners make the mistake of making a second planting, thinking that the first seed had for some reason been killed. Eventually both plantings come above ground and the plants are then much too thick. This fact is also true of parsley and carrots.

Pea.—The dwarf varieties are best for the average city garden. They are an early crop, that can be followed by later crops of other vegetables.

Potato.—The potato is really a field crop, but nearly every amateur gardener feels the necessity of growing a few potatoes. As a rule, greater value can be obtained from a small piece of ground if it is planted in some other crop. However, some city gardeners produce enough for their own use. If the city man feels that he must grow some potatoes, he should adhere to the well established rules for their cultivation and not experiment with any new schemes which are advertised to increase the production many fold. As far as is now known, no successful artificial system exists for speeding up production with this or any other vegetable.

Real gardening—and in a big city.

Radishes should be in every home garden. A small bed will supply a large family.

Spinach.—This is the best of all the "pot herbs" grown for greens. It is of the easiest culture and should be in every garden, especially as it may be taken off the ground in time to be followed by later crops of other things.

Squash—The only squash that is suitable for the city garden is the white scallop bush squash. One hill of this vegetable will not take much space and will produce a surprising number of fruits.

Tomato.—A few tomato plants should be in every garden, no matter how small. Few plants are so satisfactory and none are more easily grown. They may be trained to a fence or tied to stakes. If allowed to run on the ground they will take up more room than is necessary.

Tomatoes on stakes.

Turnips are good in a city garden as they can follow the early vegetables. They will probably produce more food value to the square foot than almost anything else.

Cooperation.—Owners of city lots who desire to establish back-yard gardens can often cooperate in such a way as to render the work easier and simpler for all concerned. I have already mentioned the fact that fences can be removed and either left out entirely or can be replaced with wire fences that will allow the light and air to get in. Other forms of cooperation consist of the community ownership of spray machines, plows or even of smaller garden tools. Often the purchase of seed may be left to one man in a group, who will buy it in quantities so that lower prices can be obtained. A community hot bed for producing early plants of cabbage and tomatoes will simplify the production of all plants of this sort and the expense of the hot bed will be distributed between several people instead of being borne by each individual. Such cooperation is urged in every community because it will reduce expense and result in the production of better gardens.

Such cooperation will often result in securing a greater yield from a given area than if the same area was to be cultivated by one person. The city man who plants a garden for the first time should also guard against trying to do more than he is able. It is far better to have a small garden well tilled than to have a large tract that is neglected.

AN ORCHARD AND GARDEN CALENDAR

Kings and Emperors and Popes have fought over the proper arrangement of the months in the year, so it is perhaps unseemly for a tiller of the soil to meddle with a royal quarrel, but to the man who lives with growing things the present scheme seems most illogical. Our year starts long before the first breath of life from the southland stirs the dormant plant life into action. The world is wrapped with a blanket of snow when the new year begins and all the noise we may make about it will not stir one leaf into activity or swell one bud upon the sleeping branch.

To one whose years are measured by the activity of his plants, it would seem that the old Romans, with their new year opening in March, had much the best of the arrangement.

JANUARY

Orchard.—Of all months, January is to the orchardist the least active. The weather usually precludes any attempt at out-of-door activity. If warm days come, some pruning may be done in the apple orchard, the vineyard and among some of the small fruit plants. It is not wise to prune either peaches or raspberries this early in the year, because the pruned stubs may be injured by severe cold weather later. This sort of in-

jury is of course liable to affect any variety of fruit, but those mentioned are the most apt to suffer. Unless there is much pruning to be done, it would better be deferred this month. Never under any circumstances prune even apple wood while it is frozen, as injury is almost sure to follow.

This is a good month in which to haul out fertilizer and place it around the trees or on the small fruit blocks.

Indoor shop work can be accomplished so as to have it out of the way when the season for out-door work opens. Be sure that all tools are properly oiled. Spray machines should be overhauled to see that no parts are broken and that the pump valves are all in good order. Pruning
be sharpened. Grafting wax can be made and if apples are to be propagated the root grafts can be prepared during this month. Examine the apple trees for eggs of the apple aphis, which will be found in small cracks in the bark and around the buds on last year's wood.

Garden.—Manure should be hauled to the garden and either left in piles or spread over the surface. Hot bed sash should be repaired and repainted and the frames for the hot beds should be repaired, or if there are none, material should be obtained from which to make them. Seed catalogues should be ordered and studied to ascertain what new varieties have been introduced and the order for the year's seeds should be sent. Do not neglect ordering the garden seed early. It is just as safe in your home as it would be at the dealer's and you are assured of its presence. By placing orders for seed late the dealer is swamped just at the time you are needing your seed and as a result it makes trouble for him, delays you, and perhaps prevents you from getting the choice of varieties desired.

In the South much preliminary work may be done toward making the garden. Our country is so large and our climate so varied that it is impossible to give exact directions for each month that will fit all sections. In the main, these suggestions are written for the conditions prevailing about the thirty-ninth or fortieth degree of latitude. Allowances can be made for relative differences.

FEBRUARY

Orchard.—This is the month in which the orchardist should plan to do most of his pruning. Severe weather may prevent the work from progressing as rapidly as it should and may cause it to lap over into March, but as March is a busy time in other ways, it is well to get as much of the pruning out of the way as possible.

While pruning, watch the trees closely for insects and fungous diseases. The San Jose scale can be readily detected by the observant pruner and wherever it is found in an orchard the trees should be marked. Later these known infested districts can be given extra attention at the spraying time.

Black rot and bitter rot both form cankers on the twigs and branches. If such cankers or rough, dead areas are found, the branches bearing them should be cut out entirely if possible. Blight cankers are also easily detected at this time and should be removed. Where it is impossible to remove a cankered branch without injury to the shape of the tree or where the removal would necessitate taking away too much good fruit-bearing wood, the canker itself can be carefully cut out with a sharp knife, the wound disinfected with corrosive sublimate solution (1 to 1000) and afterwards painted with white lead and oil or with hot grafting wax.

Notice the peaches particularly before pruning and if the buds have been killed, it will pay to give the trees an extra heavy pruning. The heavy pruning will remove much of the wood which would have borne fruit next summer, but it will induce a vigorous growth that will bear the succeeding year. See that all branches and twigs are carted out of the orchard and burned as soon as possible in order to kill any insects or plant diseases that might infest them.

In pruning plums look for evidences of black knot, and if it is present have all infected branches promptly cut out and burned. Also gather all dried or mummied plums and peaches and either bury them or, better, burn them. They carry the infection of the brown rot and their removal at this time will simplify spraying later.

Garden.—Start saving the manure for the hot beds. It should be fresh and mixed with bedding straw. Keep it under shelter where it will not be rained on, or it will lose much of its heating value. Horse manure is the only kind that is entirely satisfactory for this purpose. If the hot bed frames are not already built, have them set up without delay, as they will soon be needed. On bad days mats for the hot bed can be prepared and stored away ready for use later. They may not be needed at all, but it is best to be prepared in advance. If very cold weather should set in after the hot bed is once started the mats may save the plants from freezing, and such mats can not be prepared in a hurry.

MARCH

Orchard.—This is the best of all winter months for the application of the dormant spray. Every twig and branch must be well covered with the spray solution. Those portions of the orchard that have been found to be infested with scale insects or with the eggs of plant lice should be given extra attention. The trees should be examined a few days after they have been sprayed and if any exposed areas of bark are found, the work must be done over in these parts of the orchard.

After a spray machine has been used for the dormant spraying it should be taken to the shop and thoroughly cleaned and all of the valves examined and oiled. The strong lime sulphur solution is quite inclined to attack the metal parts of machinery and may cause moving valves and other parts to stick. It will be some weeks before the pumps are again used and if they are oiled now they will be in good shape for the big rush later.

Tree planting can often be started this month. If the ground is not frozen, this is the best month of the year for setting out trees and shrubs. If the ground should freeze again after the trees are planted it will be so much the better for the trees. It will cause the soil to be more firmly fixed around the roots.

If all of the pruning was not done last month it can be carried on in March.

Garden.—The hot beds should be started the first week in March. In some localities it is even better to get them started late in February so that seed can be planted the first of March. The hot beds will usually maintain their heat for at least six weeks and after that they still afford as much or more protection as cold frames. Consequently the starting of the beds should be about two months before the average date of the last severe frost.

Cabbage and tomato seed may be sown in the hot bed for early plants. Lettuce may be sown in hot beds for the earliest crop. Late in the month onion seed may be sown if it is intended to grow a few large onions by the transplanting method. This method has been followed in Bermuda for many years. The seed is grown inside, until strong plants are formed. These seedlings are set in the open ground at the time the regular garden is made and are carefully cultivated and kept free from weeds. The method involves more labor than does the other methods of onion culture, but it enables the season to be prolonged and thus grow to maturity in the North those varieties that have heretofore only been grown in warm countries.

If the season is advanced and the ground in such shape that it can be worked, plant a few peas in the open ground for the early crop. Some growers always plant their early potatoes on March 17th. But the proper time to plant them is when the season is properly advanced and when the ground can be easily worked.

In the flower garden sweet peas may be planted if the ground is in good condition.

See that the garden is thoroughly cleaned up and all weeds, trash and stalks of last year's plants are burned. This work should really be done in the fall, but too often it is neglected owing to the pressure of other duties.

APRIL

Orchard.—If the peach trees have had a dormant spray they will not require any more attention until about ten days after the petals fall, but if they did not receive a dormant spray, then they should be sprayed with lime sulphur at the rate of one gallon of commercial solution to nine of water. This treatment controls leaf curl and should be applied just before the buds open. The apples should be sprayed just as soon as any pink shows in the buds. Spraying must stop as soon as the bloom opens. They are sprayed again as soon as the petals fall. This work usually comes the last part of April and usually runs over well into May.

Grafting may best be done early in April just before growth starts. Be sure the scions are still perfectly dormant.

Order barrels and boxes for the fall crop. Also purchase crates for small fruits. Packages of this sort can usually be bought now at a lower price than later and the grower is always sure to have them when needed.

Garden.—Apply manure to the asparagus bed and break the surface of the soil so that the sprouts can come through easily.

Plow the garden and get the soil in condition just as early as possible.

Early beets may be planted if the ground is in good condition.

Cabbage seed may be sown in the open or in cold frames. If sown in the open, some provision should be made to protect the plants on cold nights.

Lettuce plants from the hot bed may be set in the open ground the latter part of the month. The onions started in the house should also be ready to set out if the weather is warm enough. Tomato plants should wait for settled weather.

In the open ground, lettuce and radishes may be sown and also peas, spinach, parsley and parsnip. Parsnips that have remained in the ground over winter should be dug before they start growing or they will be tough.

MAY

Orchard.—Finish the spraying left over from last month and clean up the machine as soon as you are through with it. This warning can not be repeated too often.

Remove the wrappers from around the trees, as there is now but little danger of rabbit injury and it is not commendable to have the trees wrapped during hot weather. Start cultivation in the orchards early in the month. If any trees have failed to leaf out examine them for rabbit or mouse injury. If damaged trees are discovered promptly, there may still be time to dig them out and replace them with new trees.

Cultivate all small fruit plantations except strawberries. These should be mulched between the rows with clean straw until after the crop is harvested.

Spray grape vines.

Garden.—This is the busy month in the garden, as nearly everything can be planted now. Early in the month plant beets, peas, lettuce, radishes, onions, sweet corn. All of these can be planted at intervals of two weeks so as to provide a succession of mature crops.

Tomatoes can be planted in the open ground the last of the month.

Cabbage plants may be set out. See that they go in rich

and well prepared ground, as this crop needs plenty of fertility to succeed best.

If the weather is warm, plant melons, cucumbers, squashes, which may have been started in the hot bed or cold frames. Do not plant these warmth-demanding vegetables unless the weather is suitable or more will be lost than gained.

Plant potatoes for the main crop and be sure that the seed is treated for scab before planting.

In the flower garden all sorts of annuals may be planted, but the soil must be as well prepared as if a crop of vegetables was to be grown. Perennial plants may be set this month—the earlier, the better.

JUNE

Orchard.—Grapes must be sprayed again this month. As soon as the grape berries are the size of small peas, select the best bunches for sacking.

The orchard cultivation must not be allowed to lag this month. Keep at it unless the weather should be very wet. Even then cultivate between showers.

Gooseberries, strawberries and raspberries will be gathered this month. The gooseberries will not need much attention, but the strawberries and raspberries should be given careful work. After the strawberry crop has been harvested, mow the beds, let the leaves dry for a few days and then burn them over. This practice kills many insects and gives the beds a good growth of new leaves. In old patches that have had the rows grown together, plow out paths so as to confine the plants to definite rows. After the raspberries have fruited, cut out all of the old canes so as to force the new canes to make a better growth.

Garden.—Asparagus beds should not be cut after the first of June or the roots may become exhausted. After the last cutting, apply a light dressing of manure and then keep down weeds until the asparagus shoots have had time to cover the ground.

Keep down weeds in the garden. Plant additional rows of corn, wax beans, beets, etc., to supply fall vegetables.

Plant navy beans the latter part of the month. If these are planted late they are less apt to be damaged by the bean weevil and also their cultivation is simplified. If they are planted late and the ground has been carefully prepared they will not require much attention after they are above ground. They grow so rapidly that they often cover the ground before the weeds have an opportunity to crowd them.

In the flower garden the plants should be kept cultivated. Asters should be set in the location in which they are to bloom, as should all other annuals that have been started in special seed beds or in cold frames. Roses should be pruned immediately after blooming.

JULY

Orchard.—July is one of the most trying months on the orchardist because the apples now demand their regular summer spray for the control of the second brood of the codling moth and for various fungous diseases. This spray usually comes just at the hottest part of the summer and spraying under such weather conditions is anything but pleasant. However, it must be done. The Bordeaux spray should be applied with fine nozzles and a good pressure in order to secure a fine mist-like spray, that must reach all parts of the tree.

Apples and other fruits should be thinned early this month if they are too thick on the trees. Few orchard practices pay better than this usage. As a rule, when two apples hang together one of them should come off. The one that is left will be a better apple and will be worth more money than the two would have been worth if they had been allowed to hang.

After blackberries have fruited the old canes should be cut out and burned. This custom is a great help toward keeping the patch in a healthy condition. As the new blackberry shoots grow they should be cut back as soon as they reach a height of three feet, which causes them to throw out side branches and make more sturdy canes. The first early apples will be ready to be gathered the last of this month. It is

better to make more than one picking with most early apples because they do not ripen uniformly. This fact is especially true of summer apples that show color. The Red June should be picked only when it has developed a good red color. Liveland Raspberry and Chenango are others of this class. The Yellow Transparent, while it is a yellow apple, always yields better if given several pickings. The first picking of the Yellow Transparent can be made to include only the largest of the apples. It will be found that those that remain will increase in size wonderfully.

Cultivation must be continued through this month. Keep down weeds.

Garden.—The garden must be kept cultivated through July. Weeds are the great enemy of the gardener. This rule applies to flower gardens as well as any other kind.

The ground should be prepared for the planting of turnips and other late crops. See that the surface dirt is made fine and loose. Turnips may be planted the last of the month.

AUGUST

Orchard.—If the trees show an inclination to turn yellow they must be sprayed again. In apples this yellow leaf may be caused by black rot or by cedar rust. In either event the remedy is Bordeaux mixture. Apply it liberally if any leaf trouble exists. Among peaches and plums the leaves often turn yellow through the action of other fungous diseases. These stone fruits should be sprayed with the self-boiled lime sulphur solution.

Summer apples should be picked this month and peaches also should ripen in some quantity. Harvest them on clear days whenever possible and pack them carefully. Stop cultivation in the orchards and plant cover crops early in the month.

Garden.—Plant turnips the first of the month. Also plant Chinese cabbage and kale. Winter radishes may also be planted now. Provide the Chinese cabbage with plenty of moisture and do not let the seeds dry out. After the plants are a few inches high, give them an application of liquid manure.

James Whitcomb Riley in writing about the month of August said something about "the glorious month of indolent repose". If there is any such thing as "indolent repose" for the orchardist or gardener it probably comes in this month

of heat and dust. It is a difficult month for the grower of plants, for often very little can be done to prevent the burning sun from withering the efforts of the preceding months of toil.

But in such times of drouth it is well to remember that cultivation is a great conserver of soil moisture and the more we can cultivate, the more moisture we retain in the soil for the use of our plants. So that one of the best rules for August in the garden is to cultivate and *cultivate* and CULTIVATE.

SEPTEMBER

Orchard.—Quite a bit of work can be done this month in preparation for the apple harvest. Provide plenty of picking bags or baskets and repair ladders or buy new ones. On rainy days build boxes and remove the heads from barrels in preparation for the apple packing. By doing this work now much time is saved later when the rush is on at harvest time. Clean out apple storage cellars and then spray them thoroughly inside with good whitewash or, better still, with a strong Bordeaux mixture. This treatment is to kill the spores of rot-producing fungi that are probably on the walls and floor. A little care at this time will pay dividends later.

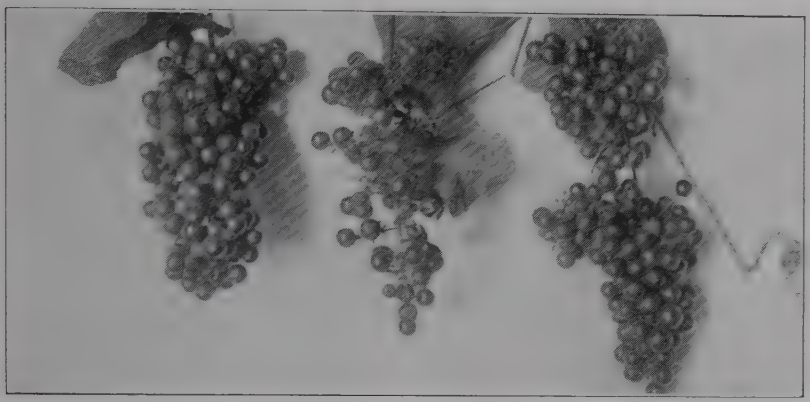
Grapes are ripe in September. Pick them and pack carefully if they are to be shipped. If sold to a local canning factory they can be handled in larger baskets and with less care. Those in paper bags will not ripen so early and will remain in good condition until November. This is usually the busy month for peaches. The Elberta and similar sorts ripen early in the month. Do not allow them to get too ripe.

Garden.—The early part of September is a rich time in the garden. Melons, tomatoes, late beans and sweet corn are at their best. Now is the proper time to save much of the seed for next year. Select the best melons, tomatoes, cucum-

bers, etc., and from them save the seed. In saving bean seed gather it from pods that are perfectly clean and healthy. This attention will do much toward securing a healthy crop next year. Select the seed corn from vigorous stalks in a crowded part of the patch. It is not best to select corn for seed when it has grown on hills very much exposed. That which has made good ears under average garden conditions is much more liable to yield good seed than that grown under very favorable conditions. In other words, a weak strain of seed might do well where all conditions were favorable, but what is desired is seed that will do well under average or perhaps adverse conditions. Navy beans should be ripe enough to pull the last of the month. Pull the entire vine and stack them up in little piles to dry out. If they can be placed under an open shed, it is to be preferred. As soon as they are dry enough to shell easily they can be threshed and the beans spread out in the sun every day for several days to cure thoroughly. Never attempt to put them away for the winter unless they are perfectly dry.

Dig potatoes. As they are dug, have some one follow along the row and select good specimens from the best hills to save for seed. This method is better than attempting to select seed from a barrel or bin. Sometimes a hill will contain only one large potato. It is not advisable to keep that potato for seed. Take the seed from hills that produce a number of good medium sized potatoes. This precaution takes some time, but it will eventually pay.

Chinese cabbage may be ready for use the last of the month.



OCTOBER

Orchard.—In the apple orchard this is the culminating month of the whole year. Now the results of all our labors are to be seen and enjoyed, and if we have the good fortune to harvest a crop of clean, perfect fruit we may consider that our work has been well done. The pleasure of picking and packing absolutely perfect fruit is one of the rewards of the fruit grower. Pick apples just as carefully as if they were much more delicate and tender structures. Sometimes a bruise may not show at the time, but it is certain to show later. Handle the fruit gently, do not throw it about or allow it to fall on the ground. As a rule an apple that falls on the ground is not fit to pack, no matter how perfect it may appear. It is almost certain to be bruised.

Pack the fruit honestly. Be honest with yourself about it. Do not put into a barrel any apples that you would not like to buy yourself if you were getting fruit from the market. Feed the bad ones to the hogs or have them ground into cider. They are worth more money as cider than they are as apples.

If you have an opportunity to sell your crop at a fair price, sell it. If the price is too low and you are equipped to store the fruit, then by all means hold it. It may even pay to send it to a cold storage plant in the nearest city and have it stored there.

After the crop is harvested the trees should be wrapped with paper to protect the trunks from rabbit injury. At the same time scrape away all trash and leaves around the trunk for a distance of two feet in all directions from the tree. This precaution will discourage the work of mice, which are often very destructive to the roots of apple.

Garden.—Dig sweet potatoes before they are frosted. It is customary to let them grow till the first frost nips the vines. Then cut off the vines at the ground. After this they will stand a severe frost without injury.

Pot a few plants of parsley to keep in the kitchen. It makes a very pleasant addition to the kitchen window and is useful as a garnish and in soups.

Onions should be gathered before severe frosts and stored for winter. Turnips may be gathered or may be left till early in November if the weather is not severe. Cabbage should be gathered this month. Chinese cabbage and kale can be lightly covered with straw and will remain in good condition late in the winter. The kale is perfectly hardy and will grow vigorously in the spring.

NOVEMBER

Orchard.—Early in the month the same activity continues in the orchard as prevailed in October. The two months often overlap and not infrequently is the weather better in November than earlier.

Late in the month is a good time to remove dead trees and burn them. They can often be pulled out by the roots at this season, while they would be hard to pull at almost any other time.

If peaches have been used as fillers in an orchard and are old enough to begin to interfere, do not hesitate to pull them out. This is the season to do it. If you allow them to remain over winter the fruit buds may escape damage and then you will not have the courage to take them out—when the good of the orchard demands it. Order fruit trees for next year's planting. By doing so at this time you are sure to get better trees than if you waited until spring after everyone else had placed his order. Have the trees held and shipped in the spring or get them now and heel them in.

This is a good month to repair the fences around the orchard and garden. Time is now to be had and posts set at this season will remain solid better than if set in the spring.

Garden.—After everything has been harvested from the

garden it should be cleaned up and all trash burned. Too often this is left until spring. It is better management to do it now.

Tender shrubs should be protected by being mulched with straw. Roses and other plants liable to winter injury should be wrapped with straw saved for the purpose.

DECEMBER

Orchard.—If the weather is favorable the first part of the month the November work can extend well into December.

Haul manure to the garden and orchard.

Mulch strawberry beds with straw, but not until after the ground freezes hard. Freezing will not hurt strawberries; in fact, it is beneficial, but freezing and thawing will cause them to pull out of the ground. The straw mulch prevents this possibility. Mulch raspberry patches that were recently planted. Old ones will usually not require it.

Late in the month the weather often puts a stop to all outdoor work in the orchard.

Garden.—There is not much to do in the garden this month. If parsnips are wanted for winter use they may be taken up after the first hard freeze and stored in sand in a moist cellar. They are best left in the ground over winter, but if this is done they are very difficult to dig when the ground is frozen.

Kale that has been protected by straw may be used until late in the month or in some localities all winter. Chinese cabbage should still be good if it has been protected by straw, but it will not withstand the same amount of cold as kale.

Hardy perennials and shrubs bordering a drive.

CHAPTER XI

The Value of a Flower Garden

I once came upon a deserted cabin in the woods of northern Michigan, miles from any settlement. The roof was falling in and the crude door drooped on its hinges, but by the step bloomed a riot of old-fashioned flowers and I knew that a woman had been a member of the household that had once occupied that outpost of civilization. She was gone, but her flowers remained, seeding themselves from year to year, and as they caught the eyes of those who passed by they proclaimed abroad, "This house was once a home."

We have for too long a time considered flowers as unnecessary luxuries. We have taken them too much for granted. Although we have had them about us, we have not felt that they were indispensable.

Flowers help to make life worth the living and anything which helps bring this condition about has what we may call a money value. Some people can understand a subject only when it is presented to them in terms of cash. They eat their food by the colorie and do not realize the wealth they miss in the beauty of the life around them. And yet even such as these will pay more for a house that has some trees around it, some flowers in the door yard and a vine over the entrance, than they would for a house that stood out bare and unattractive. They are paying their hard cash for beauty—for flowers—but they probably never thought about it in just that way. They

would miss the flowers if they were not there, but they do not give them a second thought when present. Railroads and other "soulless" corporations have never been known to spend money unless there was a chance that the same money would come back and bring more with it, and yet we find that railroad companies are among our most extensive flower gardeners. It is not enough to build an attractive station at a promising town; that station must be adorned with flowers and trees. This is a practice that has grown with the years and it has never failed to pay dividends. A station that makes an instant appeal to the traveler may bring a resident or an industry to the town; and from thriving towns railroads get their revenue.

An attractive railroad station.

Some of the largest manufacturing plants are situated literally in flower gardens. We have outgrown the idea that a factory must necessarily be a dirty, ugly structure. Plants of Boston ivy are soon grown and flower seeds are not expensive. If these are combined with a little common sense a factory may be converted from a dingy workshop, where men work for a daily wage to a place where the worker will value his job, where he will always be on time and where he will forget about the time clock.

America of all places should be a land of flowers. The first Spaniards who landed on our continent were so impressed with the wealth of flowers that they gave the land the name of

"Florida." Florida is still a land of flowers, but if those Spaniards could have gone over the whole country they would have had their first judgment confirmed because, in a slightly lesser degree than Florida and the south, this was, indeed, a land of flowers. The American forests were carpeted with flowers and the streams and marshes were rich with blooming vegetation. The shores of the Great Lakes were blue with the fringed gentian, while in early summer the prairies stretched an unbroken bed of color, not for miles alone, but for hundreds of miles.

New England's coast was a bleak spot when the Pilgrims landed there, and they had much to contend with in their first winter; but an American flower gave them their first cheer and brought new courage to their hearts—the trailing arbutus.

In our American flower garden we have opened our hearts to plants from the four corners of the globe. We have flowers from the wind-blown hills of wild Manchuria, from the sunny gardens of Japan, from Europe, from Africa and from the islands of the sea. As time goes on we will add others from far countries, but in the meanwhile let us not forget that our native plants provide us with a wealth of beauty that it ill becomes us to neglect. Let us try to encourage the growing of American flowers and plants in every way possible. We need not shut our eyes to that which is good and beautiful from other countries, but, by all means, let us open our eyes more widely to the wealth of beauty that God placed on this continent in reach of everyone.

Planning the flower garden amounts in a way to planning the home surroundings, because the flower garden includes all that is planted with the intention of improving the appearance of the house. The way in which the home grounds are planted is often an index of the character of the people who live in the house. Often the owners are too preoccupied with their other affairs or too indifferent to the real meaning of the decorative

planting around the home and so they allow a landscape architect to have entire charge of affairs.

The landscape architect has his place in modern home building; he is often just as necessary as is the architect who builds the house, but he should stand in the same relation to his client as does the house designer. Only a man devoid of ideas and ideals would say to his architect, "Build me a house", and then give his order no further thought. Of course it has been done—as the houses often testify—but it is a foolish means of securing a place in which to live, although no more ridiculous than telling a man to "Plant me a flower garden". If the owner does not know much about flowers, that is his misfortune, which he should attempt to correct, for he will miss much pleasure. He probably does not know anything about house building either, but he knows enough about what he wants to enjoy the realization of his ambitions.

The small flower garden that is planted by the owner and tended by him usually shows more character than does the finest planted "estate" that is maintained by a force of gardeners and is of interest to the owner only as a show place.

As for the old-fashioned gardens of our grandmothers, they may have missed much of being artistic successes as judged by present standards, but they reflected the love of flowers that was one of the innate characteristics of their owners. Some of these old gardens were positive joys both to their planters and to everyone who saw them. The old-fashioned flowers fitted in with the old-fashioned people who grew and loved them, and it is a wise gardener who has the insight to include plenty of the old favorites in his modern garden. Styles have changed in gardening in recent years just as they have changed in architecture. In the mid-Victorian period, when houses were built with all sorts of "scroll work" and with outlandish lines, the flower gardening coordinated with that type of architecture. It was a favorite plan to project a few gaudy beds of striking color from the midst of an other-

A well planned entrance.

wise beautiful lawn and the result was supposed to be beautiful.

We have returned to simpler styles both in regard to our houses and with our ornamental planting. Flowers are used for borders, for back grounds and for hedges. They are planted in long lines and broad masses where they will create an effect that works in with the architectural scheme of the house. The lawn should be kept open and free. There is nothing that finishes a house more than a broad sweep of graceful lawn, whose lines are not marred by flower beds or shrubs in the center. Keep the flowers back away from the lawn.

Lawns.—So few people know the value of a good lawn in improving the appearance of a place, and, by a good lawn is meant not only one that is soft, smooth and velvety with a sturdy, healthy growth of grass, but one that is a LAWN, not a grass plot in which are studded "specimen" shrubs and crescent shaped flower beds.

Still fewer people know just how to go about starting a good lawn. Primarily a lawn is nothing more than a grass plantation. The grass is a plant requiring the same elements that other plants must have in order to be vigorous. It must have to begin with a good soil, and, after the seed is planted, it must have abundant moisture. Given these two factors a lawn can be grown any place—yes, even under trees. One reason why grass sometimes fails to grow under trees is that in the beginning the trees were planted in soil none too rich in plant food and what fertility did exist has been exhausted in tree growth. As a result there is none left for the grass—and grass requires much fertility.

If the soil is rich enough to grow a fair crop of corn or weeds, it will nearly always grow grass. As a rule grass will not grow well in a soil that contains any free acid and if an acid condition exists it can readily be neutralized by the addition of lime—preferably in the form of ground limestone.

The soil for the lawn should be prepared with just as much care as if a garden crop was to be grown. Do not lightly rake over the surface, roughing the ground up a bit, and think that your soil is properly prepared for the planting of grass seed. It will sometimes really grow with that sort of preparation, but it will flourish much better if started properly.

The seed should be sown broadcast, and an abundance should be used. The desire is to have a large number of small plants rather than a few large, coarse ones and if planted too thick the plants will quickly thin themselves out.

Kind.—For the north only one grass is universally suitable for lawns and that is the Kentucky blue grass. This will thrive on many soils and will also grow under trees, if the soil is of sufficient fertility to support any grass. However, the Wood Meadow grass is often used for shady situations, but is an expensive seed to buy. Rhode Island bent grass is good, mixed with blue grass, but it also is costly. Red Top will perhaps endure more moisture than blue grass, but otherwise is not superior. If any of the more high-priced grasses are grown they should be mixed with the blue grass.

It is sometimes desirable to mix a proportion of either timothy or white clover with the grass seed at the time of planting. Blue grass requires about four weeks to germinate, while the timothy will appear in a few days. Timothy, being a strong grower, will act as a shelter crop for the blue grass. Do not expect to produce a finished lawn in one season. It is not done.

The seed should be sown as early in the spring as the ground can be put in condition. It is a good idea to have the ground prepared in the fall, then it will only need raking over in the spring before the grass seed is sown.

Clover.—On very difficult clay soils the white clover is invaluable, as it acts as a nurse crop for the grass during the first two years, during which time it is loosening the soil and

White clover used as a nurse crop on a lawn. The ground is entirely covered by the clover, makes a good appearance and the grass is coming along nicely underneath.

adding fertility to it. When the grass once gets started it will crowd out the white clover and take the space to itself.

Weeds. — Where much manure has been used in enriching the soil the first year will see more weeds on the lawn than grass. However, weeds need not cause any worry if they are frequently mowed. Most of them are annual plants that will die in the fall, so the main object is to keep them from producing seed.

A newly planted lawn must be kept watered. If allowed to dry out, the grass is given a set back, even if not killed outright, and the finished lawn is removed just that much farther into the future. Where weeds persist in the lawn the best method of destroying them is by the use of a chemical spray. There have been several chemicals recommended for this purpose, but the best is undoubtedly iron sulphate. This spray is used at the rate of two pounds to the gallon and must be applied in the form of a fine mist. Heavy applications are to be avoided, as they may injure the grass as well as kill the weeds. Applied properly this solution will not injure the grass but will kill all broadleaved weeds. It should be applied five or six times during the season in order

to kill successive crops of leaves produced by the perennial weeds. This treatment is effective against dandelion and dock, two very common pests in lawns.

After a good lawn is acquired, learn to appreciate it, and value it for what it represents. Do not start cutting up to plant shrubs or to make a rose garden or geranium bed. Flower beds placed about over a lawn are just as much out of taste as bric-a-brac on a billiard table. Shrubs and flowers, however, are just as important to the finished appearance of a place as the lawn. But keep them around the borders of the lawn and not in its midst.

The garden for annual flowers should have a place by itself, and preferably in a location where it does not form a part of the general picture of the yard as a whole. Annuals have their purpose, but for permanent effects it is better to use perennial plants and shrubs.

A framed doorway.

Vines around a doorway are always good and they may often be planted so as to be not only things of beauty, but to furnish shade at a place where it would otherwise be difficult to obtain.

The foundations of a house, no matter how important they are to the structure, are often more pleasing if they are out of sight behind a mass of shrubs or are overgrown by some good clinging vine. For this purpose use shrubs that are perfectly hardy—native shrubs

if possible. Many hardy plants may be planted among shrubbery with charming effect.

Large growing shrubs may be used for screens to cut off a portion of the yard or grounds from the public view. There are many native shrubs admirably suited for this purpose and for the most part they grow rapidly and are entirely satisfactory. The native "pussy" willow, altho technically a tree, can in effect be used as a shrub, and, as it makes a tremendous growth in one season, it is nicely adapted for the purposes of a screen plant.

One of the big advantages of using hardy shrubs and plants around the house is that they do not necessitate planting every year, as do annuals, and they nearly all improve with age. The owner learns to watch for their first activity in the spring and thus becomes interested in them so that ultimately they become a regular part of his life. This friendship with growing plants is no small part of the satisfaction that results from having a flower garden, of having one's home surrounded with beautiful plants that faithfully each year present their tribute of beauty in return for the care lavished upon them.

Daffodils as house plants.

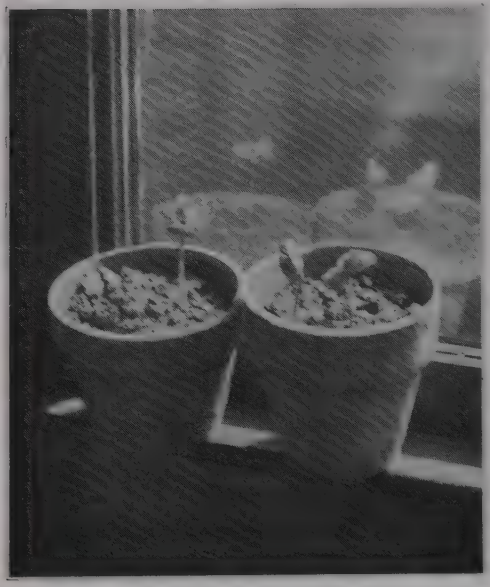
CHAPTER XII.

Annual Flowers.

Annuals are those plants which produce a crop during the same season the seed is planted and which die with the approach of cold weather. As a matter of fact, among flowers there are some listed as annuals which do not conform to this rule, but in effect and for all practical purposes they are annuals nevertheless.

Hardy annuals.—Some of the annuals are perfectly hardy and will not only grow well from seed sown in the open, but will ripen seed and seed themselves for another year. The common corn flower follows this rule and when a red is once started it seems to be able to look after itself indefinitely.

Tender annuals.—Other annuals are more tender or require a longer season in which to develop their flowers and so must be started indoors in pots or boxes. A good example of such plants is the common "moon flower" and the China asters. Sometimes perennials, such as pansy, are grown as annuals



Moonflowers started in pots on the window sill.

when as a matter of fact they are perennials. Ordinarily they would not produce blooms the first season from seed, but by being started indoors early in the year the plants gain a season on the actual calendar.

The soil for growing annuals should be a rich garden soil such as would grow good vegetables. If not in that condition plenty of manure must be turned under when the ground is spaded in the spring. One fortunate fact is undeniable concerning most soils. A section of the earth's surface taken almost any place, if not particularly good soil, can always be improved. Nothing seems to respond to good treatment quicker than the face of the earth.

In the following list of annual flowers I have tried to include only those species that are known to be satisfactory. Most of them are old sorts. Some of them were in our grandmothers' gardens. These same old sorts are still just as attractive and interesting as ever and new "introductions" have not crowded many of the old favorites off the list. In a few cases varieties have been improved by selection and in other cases really valuable additions have been made from other countries, but in the main our annual flowers are flowers that have been grown for generations and have family traditions of

their own. This fact, if no other, should give them a place in our flower beds and in our hearts as well. Figures following names, refer to height in feet.

Ageratum, 1.—This genus contains several species grown as "everlastings." The seed should be planted in the open ground after danger from frost is past. They make attractive plants for an open border and so are valuable aside from their use as dried flowers. The color varies from white to almost red, through very delicate shades of pink. The beauty of the flowers and their easy culture should include them in every garden. If used for winter bouquets the flowers should be cut before they are fully opened.

Ageratum, 6 to 10 inches.—Blue, light blue or white flowers are characteristic of this rather delicate annual which is so extensively used for flower boxes and for garden borders. It is a tender plant, requiring a long season, and the seed must be planted in a hot bed or indoors very early in the spring. Florists grow great quantities of these plants every year for sale with such plants as geranium, coleus, etc., to be used in ornamental beds.

Alyssum, ½ to 1.—Several varieties of alyssum are offered, all of which are good. The sort sold under the name Little Gem is a dwarf grower that produces an abundance of small white flowers. After blooming, the plants may be cut back, when they will bloom again. The seed may be sown in the open ground where the plants are to remain. It sometimes naturalizes itself and comes up in the same place year after year if the ground is undisturbed.

Antirrhinum (Snapdragon), 1, 2.—Snapdragon is in fact a perennial, but is often treated as an annual and as such gives excellent results. If the seed is sown in the open ground in May the plants will bloom in August if given good care. By planting indoors earlier the season of bloom may be considerably advanced. The plants are not entirely hardy, but if given a light covering of straw, will winter in good shape and produce an abundance of bloom the next season. This plant

is now being grown by florists on an extensive scale and is a popular cut flower throughout the winter. There are a variety of colors, varying from scarlet to white with many intermediate shades.

Asters. 1 to 2.—Many varieties of asters are grown as annuals and they are among the most successful of all our late blooming plants. Like most desirable things, however, they have their drawbacks and their culture is attended with several difficulties. Fungous diseases peculiar to the genus sometimes destroy the crop. This misfortune is particularly liable to occur when asters have been grown on the same piece of ground for a number of seasons in succession. It is well to change the location of the beds each year. The aster beetle is often troublesome and eats holes in the flower heads. The only successful way of eliminating this insect is to pick the infested portions and burn them. Root lice are also troublesome, but they can be killed or prevented by working some tobacco in around the roots of the plants, or spreading it lightly over the surface of the ground. The soil for asters should be well enriched. The seed is planted in boxes in the house or, if late blooms are desired, it may be sown in the open ground. House-grown plants that have been transplanted once or twice often make better flowers. There are many kinds to select from, covering a great variety of color and form. Some of the larger sorts rival the chrysanthemum in their regal beauty.

Balsam. 1½ to 2.—Altho this plant was introduced from India, it has been with us so long that it seems like a regular member of the family. It has long been a favorite in gardens in spite of the fact that the flower habit is such that it is not well suited for cut flowers. Plant the seeds in good soil in May.

Calendula (Pot Marigold). 1.—This is the "Marygold" that was cultivated in England in Shakespeare's time. It is a very old favorite and has lost none of its ancient charm. The flowers come in various shades of yellow and are produced

continuously from early summer until frost. It is one of the easiest annuals to grow. Plant the seed where the plants are to remain as soon as the ground is well warmed in the spring. By planting a few seeds in pots late in summer the marigold can be used as a house plant and will bloom well during the winter.

Calliopsis. 1 to 2.—Related to the perennial Coreopsis. Seedsmen offer a number of varieties of Calliopsis, varying in color, form of flower, and size of plant. Most of them are good and some of them are natives of this country. The seed should be sown where the plants are to remain and after they are a few inches high they may be thinned so as to stand about six inches to a foot apart, depending on the size of the variety grown.

Candytuft. 1.—Seed should be sown from mid-April until June in order to provide a succession of bloom. This is a splendid plant for securing a mass of color and for this reason should be planted in large beds. It is to be had in a variety of shades of red and in white. It is excellent for cut flowers.

Celosia (Cock'scomb). 1 to 3.—This plant is an old favorite in annual gardens, but is inclined to grow rank and coarse. It lacks much of being a desirable plant when grace and color are desired. May be planted in open ground or started in the house and transplanted later.

Centaurea (Corn Flower). 1½.—Seedsmen offer a number of sorts of cornflower, some of them native American wild plants. They are all annuals, but usually re-seed themselves and appear year after year in the same place. Seed should be planted in the open ground early in the spring. The sweet sultans are a form of the cornflower and are more desirable in point of beauty. Shades of color vary from white to rose and lavender. They are excellent for cut flowers and should be grown in every garden.

Cosmos. 3.—This new introduction to our northern gardens has proven of great value. No other plant can take its place for the production of an abundance of graceful bloom late

in the summer. As it is a large growing plant it should be planted behind other lower growing forms and in such situations produces a good back ground for almost any of the earlier flowers. In the latitude of central Indiana cosmos will sometimes re-seed itself and appear in the same place on successive years, but it is not regarded as entirely hardy. Most growers start the plants indoors and set them where they are to remain after danger from frost is past. When the plants are a foot high the central shoot should be cut off so as to make the plants more bushy. .If this is not done the plants will often grow so tall that they are unable to support themselves and as a result fall over in great disarray. An early strain has been introduced which produces its bloom from early August until frost. The flowers, however, are not so large as in the late flowering sorts and the variety is otherwise less desirable. It is a good plan to have some of each sort. The colors are chiefly shades of red and a fairly clear white.

Eschscholtzia (California Poppy). 1.—The California poppies are very bright flowers of the easiest culture. Seed should be sown where the plants are to remain very early in the spring. The variety sometimes re-seeds itself. If the flowers are kept gathered before forming seed the plants remain in bloom until frost. With a little protection the plants will live over in mild winters.

Euphorbia (Snow on the Mountain). 2.—This plant is grown for the effect of its pretty green and white foliage. The flowers are inconspicuous. Seed may be planted in the open ground where the plants are to remain. It makes a good back ground for other low growing flowers. This species should be handled with care as the juice acts somewhat like that of poison ivy when it comes in contact with a tender skin. Like poison ivy, too, many people can handle it with entire immunity.

Four-O'clock (Marvel of Peru). 1½.—An old-fashioned annual not of unusual value except for its associations. There

are other better plants, but this one can be easily grown almost anywhere by anyone. The seed is sown in the open ground in May.

Globe Amaranth. 1½.—This is another flower grown for winter bouquets. The flower heads are composed of many small, bright colored bracts which hide the true flowers. These heads resemble the flower heads of red clover. They should be cut before the flowers are fully mature and hung up to dry for winter use. They remain attractive long into the winter. They are not as attractive, however, as some of the other everlastings. Seed may be planted in the open ground as soon as the danger from frost is past.

Helianthus (Sunflower).—The sunflower, coarse as it is, is not to be despised. It has considerable value in many situations. Nothing will serve quite so well to screen a rough corner quickly—and the flowers are far from being unpleasant to the sight. Another fact that should not be disregarded, is that the sunflower will provide an abundance of food for many kinds of birds, and it is always interesting to watch the little creatures hanging on desperately trying to get their breakfast from the downward-bent seed heads. Try to find a place for a few at the far end of the garden. The seed can be sown as soon as the danger from frost is past. Needless to say, they like a sunny situation.

Helichrysum (Strawflower). 1½.—This plant is one of the most popular of the everlastings and is grown from seed planted in the open ground. Like all other everlastings, the flowers should be cut before they are fully opened so as to cause them to hold together more firmly. Strawflowers come in various shades from white to crimson.

Kochia (Summer cypress). 3.—Related to some of our common weeds and, like them, grows very rank whenever it has an opportunity. It is a plant without any particular character to recommend it except that any one can grow it under any sort of condition. It is to the flower garden what the Ailanthus is to the shade trees. The seeds are planted in the

open ground after frost dates are past and it should be thinned to stand two feet apart. Its best use would be as a background for the better low-growing plants.

Larkspur. 1½.—In recent years we have seen remarkable improvement in size and color among the annual larkspurs. These old-fashioned flowers were always favorites and they have good reason to be, for they are easily grown, make a fine appearance in the garden, bloom from early summer until frost, and are excellent for cut flowers. The seed should be sown in the open ground by the first of May or earlier if the weather will permit. In a favorable season the plants will be in bloom by July and will continue to bloom till killed by frost. Frequent cuttings will tend to make the plants bloom better and will keep them in better shape generally. A double sort has become popular and grows nearly twice the size of the single forms.

Marigold. ½ to 1½.—There are a number of flowers that are known by the name of marigold. Calendula was known under this name in old English gardens. The marsh marigold is a native spring flowering plant that grows in swampy places. The marigold of the seedsmen, however, belongs to the genus *Tagetes* and is quite unlike any of the other plants that sometimes bear its name. There are two common forms, the French and the African. The French marigold is a dainty little yellow plant that is excellent where a mass of yellow bloom is desired. It is of dwarf habit and is a splendid thing for edgings and for window boxes. The African marigold is a much larger growing plant and produces a wealth of color, ranging from clear lemon yellow to brilliant orange. In the French varieties these same colors prevail and in addition the flowers are often striped with rich brown. Both forms are excellent plants. The leaves have a distinct odor when crushed that is very unpleasant to some people, but rather attractive to others. Probably no other plant can be grown to perfection with as little care. The seed is planted in the open ground early in May and the plants will be blooming by

the last of June and will continue to bloom until after frost. If the seed is scattered in some out-of-the-way corner it will often grow with no attention at all.

Mignonette. 1 to 2.—This plant is a native of Africa, but has been in cultivation in flower gardens so long that it is now quite cosmopolitan. The flowers are insignificant in appearance and are neither graceful nor beautiful in color, but the fragrance is such that the plant is a general favorite. The seed can be sown in the open ground in late April, and again in June or July to have a late crop. The plants do best if they are grown in partial shade.

Pansy.—These interesting flowers have been developed from one of the wild violets native to the cooler portions of Europe and have been in cultivation for centuries. They will not withstand hot, dry weather and the plants often perish in midsummer. In the cooler parts of the United States they often thrive from year to year, as they are in fact perennials. I have seen pansy beds in northern Wisconsin that produced an abundance of flowers year after year with practically no attention and no winter protection except the snow. They are often treated as annuals and for that reason are in this list. For such purpose the seed should be sown in a cold frame very early in the spring. The soil should be well prepared and should not be allowed to dry out after the seed is planted. The young plants are very delicate and require careful attention. The seed should be very lightly covered. After they have attained some size the young seedlings are thinned out or transplanted so as to allow each plant plenty of space. They are set in the open ground as soon as they are large enough to withstand handling and will bloom the same season. Pansy plants are produced by the professional growers each year in great quantities and it is probably best for the amateur to purchase his plants from them. Late in summer seed can be planted for early bloom the next spring. The plants should be well grown by the time cold weather appears so as to be

Petunias.

in good condition for wintering. In sections where there is considerable freezing and thawing the plants must be mulched to prevent them from drawing out of the ground.

Petunia.—These are favorites in nearly every garden because they are so easily grown, are such vigorous growers, and produce an abundance of bloom. The flowers vary in form and in color. The single forms may be planted out of doors in the garden as soon as the ground is warm, but the double and more tender sorts thrive best if started in the house, in a cold frame, or hot bed. The seed is very small and should not be covered deeply. If the ground is pulverized finely and the seed sprinkled over the surface it will usually bed itself. It is best to cover it very lightly by sifting a small amount of good soil over it.

Phlox Drummondii. 1.—This annual phlox is a native of Texas, but is a very satisfactory annual well into the north. The seed can be planted in the open ground the first of May and will bloom in about six to eight weeks. Like many other plants, this one does better if started in a well prepared seed bed and transplanted to the desired spot later. It will grow in almost any soil and is a very satisfactory plant. As a bedding plant, where a solid low mass of color is wanted, it is

excellent and is also exceedingly satisfactory in flower boxes or hanging baskets.

Poppies. 1½ to 3.—There are several kinds of poppies that are grown as annuals, but all of them require about the same care. No class of plants will produce such a brilliant color effect as will the poppies when they are properly handled. They should be planted in large masses where their colors will have an opportunity to show as a whole. Individual plants are not effective. They make great material for banking against the borders of a flower garden where strong effects are desired. For the most part they are not useful as cut flowers because the petals are inclined to fall soon after the flower is picked. Sow the seed very early in spring where the flowers are to bloom, as they do not survive transplanting. If they come up too thick, thin them out so that they stand about six inches apart. The Shirley poppies are among the most popular of the single sorts and "White Swan" and "Cardinal" are good doubles.

Portulaca (Trailing).—This popular dwarf is useful for edging and among rock work. It prefers plenty of sunshine. The flowers are bright and attractive. The seed can be sown out of doors as soon as the ground is warm and danger from frost is past and is another very small one that must be planted carefully. One great danger with small seeds is that they will be planted too thick. With the more careful planting they will usually require thinning.

Rhodanthe. 1.—This plant is another good everlasting. It is smaller and more delicate than the Helichrysum and is handled in the same manner.

Ricinus (Castor Bean). 3 to 10.—This valuable annual is good as a background for flowering plants. There are many horticultural varieties offered by the seedsmen, varying from dwarf plants with variegated foliage to immense plants that would serve well to hide a small barn. Seeds are planted in the open ground after danger from frost is past.

Salvia (Scarlet Sage). 2.—This plant has long been a fa-

vorite for situations where a belt or mass of scarlet color is desired. It furnishes a good clear color, but the plants are not particularly attractive in form and is not what could be called "characterful." The seed must be sown early either in the house or in a hot bed for the best results. Florists annually produce thousands of plants of salvia for bedding material.

Scabiosa. 2.—In spite of its rather unpleasant sounding name, this annual should be more widely grown. It is excellent for cut flowers and is easily grown. There is a range of color from white to scarlet. The seed can be sown in the open beds, but is better to be started in a special seed bed and later transplanted to the place where it is to bloom. This treatment improves the plant habit of many of our annuals.

Stocks. 2.—Popular annuals that are not as widely grown as they might be. They are not only beautiful, but fragrant as well and make excellent cut flowers. Seed should be planted in a hot bed in February or March and transplanted once or twice to develop a good root system before being planted in the open ground.

Verbena. 1.—Every old garden had its bed of these charming plants. They should be more extensively planted in our modern gardens. Seed may be planted in the hotbed in February for a crop of early bloom or may be planted in the open in May for bloom later in the summer. By keeping the bloom cut, the plants will produce flowers till frost. As a rule they are inclined to trail over the ground and will produce great mats of bloom.

Xeranthemum. 3.—This is another of the everlastings so is treated in the same manner. It is one of the most attractive in the list.

Zinnia. 2.—The last plant on the list, but by no means the least important. They are old garden favorites and are good both for their appearance in the garden and also as cut flowers. They are offered in a variety of colors and in form ranging from rather interesting single bloom to those which

are very double and with curled petals. The plant has been improved by selection in recent years and some of the newer varieties that are offered are excellent. The seed is planted in the open ground where the plants are to remain about the first of May or whenever the soil is warm and in good condition to work. They will thrive in a variety of soils, but require full sunlight to be entirely successful.

VINES.

There are a number of good annual vines, but in most places it will be more profitable to plant perennials for all purposes where climbers are desired. The following brief list includes the best of the annuals.

Balloon vine.—A quick growing vine, with insignificant white flowers followed by expanded seed pods from which it takes its name. The foliage is good. Plant in the open ground in May.

Cobaea.—A rapid growing vine, but must be started indoors and set in the open after danger from frost is past. Has interesting flowers.

Dolichos (Hyacinth bean).—One of the best of the quick growing annual vines. Makes an attractive plant when grown over wire fences. In the south is used as a stock feed plant.

Echinocystis (Wild cucumber).—A native wild plant that has much value as a climber. Plant in open ground in May.

Humulus (Japanese Hop).—A recent introduction from Japan. It has good foliage and in rich soil makes a good growth.

Ipomoea (Morning glory).—The old-fashioned morning glory is the one best vine for a quick growth to cover some unsightly building or to screen an unsightly corner. This old favorite will re-seed itself, however, and can become a troublesome weed. The "moonflower," a more recent introduction, blooms after sundown. Its habit of growth is much slower and must be started indoors. The seeds are very hard and a

hole should be cut or filed in the outer seed coat before planting to hasten germination.

Nasturtium.—The nasturtium is one of the best annual climbers, or rather trailers, as it is more inclined to trail than to climb. It demands much moisture so must not be allowed to dry out. Seeds are planted in the open ground in May. A dwarf form does not trail to any extent.

Sweet Peas.—This is the one annual vine that is entirely justifiable in any garden. In fact it is almost a necessity. The vines are grown not for their value as climbers, but for the bloom, which is as beautiful as that of any flower we have.

The soil for sweet peas must be rich and deep and should be prepared with the greatest care if success is expected. It is a plant that requires plenty of moisture and does not thrive well in very hot weather. The finest sweet peas are grown in the cooler parts of the country. The flower gardens of northern Michigan are noted for the excellence of their sweet peas.

The seed should be planted as early in the spring as the ground can be put into condition. Some amateurs attempt always to plant the seed on a certain date, but nothing could be more foolish than this practice. The time to plant is when the season is right. Plants do not always accommodate themselves to the solar calendar. It is often desirable to plant the seed about an inch deep in the bottom of a six- or eight-inch trench. As the plants appear in the bottom of the trench, fill in with good earth, causing the plants to push up through the filling. By the time they have reached the top of the trench their roots are several inches below the surface and they are less apt to be affected by dry weather. Some support must be furnished for the vines, and the flowers are to be kept picked off and no seed allowed to form. This procedure prolongs the season of bloom much beyond what it would be if seed were to be produced.

CHAPTER XIII.

Perennials.

The use of perennials in the flower garden and in connection with shrub planting has fortunately been on the increase during the past years, and many of our American gardens are developing that air of permanence that can not be produced by the use of annual plants. Perennials are plants that live over from year to year. Some of them are perfectly hardy and some require protection in severe winters. With the greatly increased interest in this class of plants nurserymen have introduced a host of forms not generally known and many of them are worthy additions to any garden, but some of them are intended chiefly to grace the pages of the catalogues and it were better for the gardener if they were allowed to remain there.

Permanent.—Although perennials do not require replanting each season, the grower must not get the notion that they will succeed under neglect. It is true that they generally require less care than do the annuals, but some rules must be observed and some work must be done if the grower is to secure results of which he can be proud.

Soil.—When perennials are planted the soil must be in the best possible condition. In growing annuals the soil is worked up each year and mistakes of one season can be corrected the next, but with perennials there is no chance to retrieve an error after it has once been made. For this reason the grower should insist that his soil be stirred deeply and that it be pro-

vided with an abundance of plant food. Turn under plenty of manure and make sure that the soil is well drained. If the subsoil is stiff and hard it should be excavated to a depth of two or three feet and the bottom of the bed filled in with broken jugs, tin cans, pieces of brick and mortar—anything in fact which will provide for the escape of excess moisture in wet weather.

Propagation.—Perennials in many cases may be grown from seed, but it is best to purchase the young plants from a florist or nurseryman who makes a business of producing this class of stock. It is a business in itself and the young seedlings invariably require more care than do the plants after they are well grown. Some kinds are best reproduced by making cuttings or by division of the roots. Phlox and chrysanthemums make large clumps that are easily divided. After a clump of this kind has stood for several years it will flourish better if it is taken up, the roots divided and replanted in newly prepared soil.

Vines.—Many perennials are climbers and are greatly superior to annuals where vines are wanted. Some of them have in addition to their permanence a good winter appearance that makes them beautiful throughout the year.

In the following list an attempt has been made to include only those plants which are of known value and which are sure to succeed in the hands of the average grower. Some of them are native wild plants that can be collected from the woods and fields. This class has been too much neglected, as it furnishes an abundance of good material that is perfectly hardy and is often superior in beauty to some of the horticultural varieties put out by plant dealers. The utilization of this class of plants should be encouraged just as much as possible in our American gardens.

Achillea.—This genus is represented in our woods and pastures by the common yarrow, a plant with finely cut leaves

and the heads of white flowers. Occasionally the flowers are a bright pink, but this is not a common characteristic, as the pink forms often reject and under cultivation. Another form of the plant offered by plant growers is A. Pumilum, variety, "The Pearl." This is a double form, producing an abundance of small double white flowers. The plants are perfectly hardy and will grow in almost any soil. They often grow in old pastures and seem to thrive even with the grass growing close about. On this account this is a good plant for naturalizing in places where it can not be regularly cultivated.

ASTERS.—There are some half-hardy members of this genus that make admirable bedding plants. There are two common wild flowers often called asters, but which belong to different genera. These plants are the late wildflowers of the spring woods. One is hyacinthoides and the other lanceolatus. They are low growing and will thrive in any moist, rich, shaded soil. They are of value only for their bloom in early spring. The true asters are larger growing plants, blooming later in the year and with the flowers followed by interesting seed heads. A. Amellus is often cultivated. Flowers white. Plant grows to three feet tall. It will withstand some shade. The seed head is cylindrical in shape, while that of the A. Novae-Angliae is spherical. This latter form is also cultivated in gardens and thrives best with a sunny exposure. Of the improved forms, the Japanese anemones are by far the most beautiful and are worthy of a place in any garden of hardy plants. They are offered in a number of varieties.

ASPARAGUS.—The common cultivated form of the American market garden is a good garden plant, although it is not so desirable as the more ornamental introduced species. All of the asparagus are perfectly hardy and will grow in a variety of soils, but prefer one that is not too heavy. If the garden soil contains too much clay it would be well to work in a small proportion of sand to loosen it before planting these plants. The large orchard, or purple flowers are produced in great

abundance in early summer. They prefer a situation which does not receive the full sunlight.

Asclepias.—This group is the one which the milkweed belongs. Some people looking at this plant wholly as a weed will feel that it has no place among the aristocrats of the hardy flower garden, but even the more common milkweeds are not to be despised. While it is true that it is an ordinary weed in many localities, that fact does not detract from the beauty of the plant. If it had been imported it would be grown by every florist. The species that has the most value to the plant grower, however, is that known as "butterfly weed," a form most common in low, wet places. It produces great heads of brilliant orange yellow flowers that are as striking and beautiful as any of the pampered pets of the most fastidious gardener. Although the plant grows wild in rather moist situations, it will thrive in many soils and where a number of plants are set together they furnish a dash of color that cannot be equaled by any other plant. While the plants are in bloom they are constantly visited by hosts of the Monarch butterfly whose orange and black coloring fits in with the general color scheme of the flowers. They must be watched at this time, however, because the butterflies are not there purely for ornamental purposes. They are usually feeding and incidentally laying their eggs on the foliage. The eggs produce a green and black striped caterpillar which is about the only serious insect enemy of the plant. They are usually not numerous, however, and can be readily picked off by hand. If they are allowed to continue their development they produce, eventually, one of the most beautiful chrysalids. Truly even the pests connected with this plant have an undue share of beauty.

Aster.—For the hardy garden there is just one best aster and that is the form known as the New England aster. It is perfectly hardy and makes a wonderful show of purple bloom in the fall of the year. It can be planted in clumps among the

shrub border and will furnish a wealth of color just at a time when flowers in such situations are needed. The native form has been improved by selection until now there are several shades of color offered by plant growers. Aside from the variation in color they are all very similar. There are many native asters in our autumn woods, but none of them have the value of the above form. Some of the delicate, small flowered, blue and white kinds are very pretty when naturalized in great masses along ravines in wooded places, but for the average garden they are not particularly commendable.

Campanula.—Bailey lists forty-nine species of campanula and many varieties under each species, so it will readily be seen that this is a large group. It contains, among others, the bluebell, noted in Scottish literature. Its growth is not confined to Scotland however, as it is also native over a large part of the northern United States. The best of the group from the standpoint of the flower gardener are the Canterbury bells, those graceful, bell-shaped flowers which come in a variety of pleasing shades and which are so well adapted to the conditions of the average garden. C. persicifolia is a taller and more attractive plant than the Canterbury bell, but the flowers are not quite so attractive.

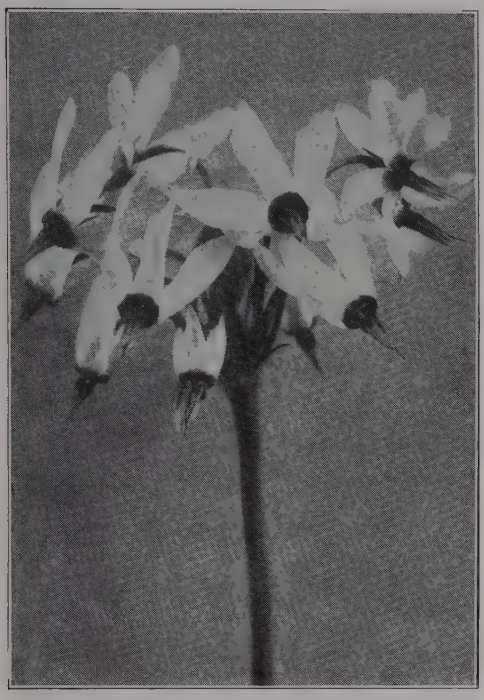
Chrysanthemum.—The old-fashioned hardy chrysanthemums of the old farm gardens are among the best hardy plants that can be planted. They produce an abundance of bloom long after everything else has been killed by frost and even after a severe freeze they will often continue to open their flowers. If very severe weather should threaten to ruin the bloom, the stems may be cut and brought in the house even long before they are ready to open and when placed in water they proceed to develop their flowers in the most perfect way. Recently too many tender sorts have been offered in the catalogues and growers have been disappointed to find that their plants died during the winter or were ruined by early frosts. For that reason the plants from old established patches that

are known to be hardy are the best. Some nurserymen realize this disposition and have collected their stock from plants that have been growing in old gardens for years. Such plants will give universal satisfaction and will make one of the best additions possible to the hardy border. The plants will grow in any good garden soil and require but little attention. They are best planted either in the fall or in the very early spring before they start to grow. The growing of the fancy varieties of chrysanthemum should be left to the commercial grower who is equipped to take care of the plants and who understands their requirements.

Coreopsis.—This bright yellow plant resembles the annual cosmos in nearly everything except color. The flowers are splendid for house use and their constant cutting tends to keep the plants in bloom for a longer period. They come into bloom early in the summer and if not allowed to form seed will continue to bloom until frost.

Delphiniums.—The perennial delphiniums or larkspurs are among the very best of the hardy plants for the flower garden. The Chinese forms are small flowered dwarf plants suitable for any position where a low, dark blue flower is desired. The stately English delphiniums are among the most beautiful of the group. They grow from four to eight feet tall and will bloom from early summer till frost if they are properly treated. As soon as a spike of flowers is through blooming, that is when the top flowers are beginning to fade, the flower stalk should be cut to the ground. The plant will then throw up another great spike to repeat the show. They thrive in any good garden soil, but the richer it is, the better flowers will be produced. The colors vary from pure white through various shades of blue. The light, clear blues are very effective, as this color is not at all common in plants capable of producing a large mass of bloom.

Dodecatheon.—This native American plant, commonly called the "shooting star," is an excellent perennial for situa-



The bloom of the shooting star resembles a Cyclamen.

tions where a spring blooming plant of low growth is required. It is characterized by spikes of white or pinkish flowers of a very intresting shape, growing much after the habit of the Alpine violet or cyclamen. The flower suggests that of the cyclamen very decidedly and no doubt our little native plant would be a greenhouse favorite if it were not so common in the woods.

Hepatica.—This is another familiar plant of our woods that deserves to be recognized in our gardens. While it is a spring blooming plant, the foliage is persistent and beautiful all summer, making a ground cover in shady places. The leaves remain green, or rather red bronze, all winter and until the flowers come in the spring. It is one of the most desirable plants to mass in beds on the north side of houses where it will have shade and moisture. Plants that will thrive in such situations are needed and the hepatica should prove a welcome addition to the list.

Hollyhocks.—Every one loves the good old-fashioned hollyhocks. They are rank growers and are not particularly graceful and many other plants produce colors that appeal more to the artistic eye, but at that there is something stately

about the plants that cannot be overlooked. They recall old gardens and old times and through long association have won

Good old-fashioned hollyhocks.

the place in the hearts of flower growers that will cause them to retain their place in the garden. They are splendid to use as a background for other flowers or in a mixed border of tall growing plants. Their wide range of colors causes a regular riot in the garden—an effect that is often wanted.

Iris.—The flags are among our most useful perennials because of the fact that they will grow in such a variety of

Iris bordering a path.

situations and are so universally beautiful. There is nothing better with which to border a bed of other flowers or to use along a path or an approach to a house. They grow stiff and upright and have no tendency to lop over on their neighbors, although the roots will in time spread and cause the individual patch to enlarge and the border strip to become slightly wider. The German iris, so called, although it is not a native of Germany, is one of the most useful, as it adapts itself to

many types of soil and will do better in poor soil than almost any other perennial. It requires good exposure to sunlight, however. After the first year or two it does not seem to need cultivation and is able to take care of itself very effectively. The Japanese iris is a much more showy plant, producing flowers of great beauty of form and coloring. It is by far the finest of all the group, but unfortunately is a moisture-loving plant and if deprived of its moisture it often fails completely. The same statement is true of the blue flag of our American marshes. It is an attractive plant but it will grow only in wet places. The Spanish iris is a delicate form of easy culture. The bulbs, for this is a bulbous form, are planted early in the fall and bloom the next season. Altogether there are more than a hundred species of iris and many hybrids between species. No flower has been more highly developed and few forms will yield greater satisfaction to the lover of flowers.

Linum.—The ornamental flax is a pretty little perennial with delicate foliage and covered with a multitude of blue flowers. It comes into bloom early in the spring and remains covered with flowers nearly all summer. The plants are not tall growing and not bold in coloring, but for a situation where delicacy and grace is desired they are splendid.

Lobelia.—The red flowered lobelia, or cardinal flower, is a beautiful perennial, but requires plenty of moisture. If a place can be secured where moisture is assured throughout the season it would be well to try it, but in the average garden there are other plants that are more apt to succeed.

Monarda.—This is one of the mints that is well worth cultivation in a hardy border. The flower heads are not only interesting, but they also attract numerous butterflies and provide forage for honey bees. It is a wild plant over the most of the country.

Pentstemon.—There are a number of species of pentstemon native in the United States, but P. digitalis is the form chiefly cultivated. It produces attractive spikes of white flowers in early summer and is worthy of more extended cul-

tivation. P. grandiflorus is native in the prairie district. It has larger flowers of light lavender blue.

Peonies.—Perhaps no other hardy flower is so widely

A native monarda.

cultivated as the peony. Certainly none is more admired. The bloom exceeds the rose in beauty of form and color and most varieties are equally fragrant. In addition to producing the most splendid flowers, the plants produce clean, vigorous foliage that is seldom attacked by insects or fungous disease and which makes an excellent appearance throughout the season. If only one hardy plant can be selected, let it be, by all means, a peony. The plants that are furnished by nurserymen are usually single roots cut from a large clump. As a rule these single roots will produce only one or two stalks the first season they are planted and the results are apt to be disappointing to the amateur, especially when he is told that the plant should not be allowed to bloom the first season. For immediate effects it is best to purchase original clumps of several years' growth, although such clumps will cost about five times as much as the single plants. The roots may be planted either in the fall or in very early spring before growth starts. In any event they should be placed in the best soil obtainable and in a situation where they will have an abundance of light and air. They do not succeed in even partial shade and their excellence entitles them to the best location in the garden. No plant is better adapted for grouping around houses and along drives and walks. There are many varieties offered and practically all of them are good. Some are single, but the most of them are double. The great white variety, festiva maxima, is one of the finest flowers in existence.

Phlox.—There are several native species of phlox that are worthy of cultivation. One of these, P. divaricata, is the common wild flower known as blue phlox and is to be found in rich woods over a greater part of the eastern states. It is suitable for garden culture and as a plant for early bloom in a shrub border it is excellent, making large clumps. P. subulata, or moss pink, is a dwarf form, blooming very early in the spring and covering itself with charming little lavender or rose pink flowers. It is a creeping plant, with grass-like

foliage, and if given an opportunity will form great mats, covering the ground for yards in every direction. There is nothing finer for a ground cover in situations where the soil is poor and where an early show of color is desired. This phlox does not succeed in rich soil. It grows to perfection on

Phlox divaricata, one of our native plants.

difficult yellow clay and if it can get its roots in a crevice under a stone it will thrive as well as if it were growing in a rich garden. The tall growing phlox of the garden is either P. paniculata or P. maculata or a cross between the two. Nearly all of our named varieties are such hybrids. From this it will be seen that this is a strictly American family. These tall growing phlox are among our best hardy plants

and if given good soil will soon make large and showy clumps.

The *Missouri Botanical Garden* gives the following directions for the cultivation of these hybrid plants: "The garden culture of phlox is very simple. As they are gross feeders, the soil should be worked up to a depth of eighteen inches to two feet and well enriched with well-rotted manure. The manure is especially necessary in light sandy soil to conserve moisture. It should be used sparingly in stiff heavy soil, however, in view of a prevalent spot disease caused by a fungus, *Cercospora phlogina*. The disease is characterized by circular brown spots on the foliage, which on the upper surface show a dark brown border. The distance of planting should vary from two to three feet, depending upon the effects desired. For color grouping clumps may be set two feet apart without being overcrowded. Phlox suffer in hot weather because of their tendency to form roots at the surface. To avoid this, mulching with well-decayed cow manure should be resorted to in June. Moderate shade is also beneficial during the hot part of the day, so that an eastern or western border is preferable to one facing south. For the best results phlox should be divided every three or four years."

Physostegia.—Another American plant that is widely cultivated in gardens, but not as extensively as it should be. It produces tall spikes of pink or white flowers and makes a graceful addition to the hardy border.

Rudbeckia (Golden Glow).—This perennial is one of the best of the tall growing plants. It is not what could be called a graceful plant, but its vigorous growth and unfailing supply of bright yellow flowers give it a value that a less thrifty plant would lack. Being tall growing, it should be placed where it will have plenty of room. Sometimes the stems require support or they will blow over in the wind. They can be strengthened by pinching out the leader when it is about two or three feet high and causing the plant to branch.

Tradescantia.—The native spiderworts make excellent

little plants for the hardy border and as they will endure some shade they may be planted among shrubs or under trees. The flowers are blue or purple and last but a short time, but are quickly followed by others.

Trillium.—For a cool, rich spot in the garden there is no more striking plant for early bloom than the large white trilliums. These are native in our rich woodlands. The tall stalks bearing the three-parted leaves of sturdy green, appear

Tradescantia, or spiderwort, makes a fine perennial in a sheltered location.

early in the spring and the bloom opens soon after the leaves reach their full development. This is one of our most interesting native plants and should be more widely grown. Many plant specialists list it in their catalogues, but it can also be obtained direct from the woods in many parts of the country. The bulbs should be planted deep—at least as deep as they grew in the woods, about six to eight inches. There are other

One of the showy trilliums.

varieties of native trillium, but for the most part they are not suited for garden planting. The little snow trillium, one of the earliest wild flowers, may be naturalized in the border or on the lawn in a sheltered situation. It grows only a few inches high and produces white flowers almost as soon as the snow is off the ground in the spring.

Verbena Venosa.—This is a hardy form of the verbena and should be more widely grown. It is often found in old gardens where it has been established for years. When allowed to have its own way it will form large mats of deeply cut foliage and will produce a perfect mass of flowers from early spring until frost. These flowers, a purplish violet in color, attract large, black, swallow-tail butterflies in great numbers. Any bright day in summer will see the plants shadowed over by these insects which seem to visit it only for the nectar of the flowers, as the larva of this butterfly feeds on other plants.

Yucca.—The common yucca is a good evergreen plant, perfectly hardy, and valued not only for its great spikes of

white flowers, but also for its striking stiff, green foliage, which remains in good condition indefinitely. It is of the eas-

The Emperor Daffodil.

iest culture and often escapes from cultivation and runs wild. It is a good plant to give a touch of green in the winter among the shrubbery.

Paper White Narcissus as grown in the house.

DUTCH BULBS

There are many sorts of plants commonly sold under the name of Dutch bulbs, because of the fact that their culture has been developed to its highest state in Holland.

Among these, the various members of the narcissus family hold a high place and are among our best perennials for spring bloom. The great yellow daffodils are for the most part perfectly hardy and can be planted among shrubs with very pleasing effect. The variety known as Emperor is probably the best for this purpose. The bulbs should be planted in the fall in soil which has good drainage. It is a good plan to dig a trench about seven or eight inches deep and put an inch or two of sand in the bottom of it. On this sand the bulbs are placed and covered with good earth.

The paper white narcissus is also an excellent form for naturalizing among shrubs and trees and is handled exactly like the daffodil. The "poet's narcissus" is perfectly hardy and makes a good plant for outdoor culture.

All of these can also be grown in the house by planting in boxes and pots and allowing them to remain out of doors until cold weather approaches. They are then brought into a cool cellar and later into a warm, lighted room.

For the hardy border there is no more effective plant than the Darwin tulips, which are just as different from the small early flowering tulips as could be possible. The Darwins produce tall stems, bearing great cup-shaped flowers in a wonderful variety of brilliant colors. No hardy garden should be without them. They are planted and treated just as the daffodils. Ground mice have a great fondness for the bulbs of the Darwin tulip and the beds should be examined every fall for signs of these pests. If they are present, as will be indicated by their runways, means must be employed to exterminate them. Oatmeal dusted with strychnine can be placed in the entrance to the burrows and the hole covered with a stone or clod. This will prevent birds from eating the grain. If after

a few days the holes are again open the dose should be repeated. If the holes remain closed and no new openings appear you may feel sure that the mice have perished.

PERENNIAL VINES

Ampelopsis.—The five-leaved ivy of our forests makes a good vine to cover old stumps or to run over a dead tree, but it is not so effective on walls and on foundations as is the A. veitcheii or Boston ivy. This is a splendid plant and makes the best foundation screen in the list. Sometimes it is reported as being difficult to get started clinging to the wall. This nearly always means that it is not making a vigorous growth, as it would if it was planted properly in the right kind of soil. Too often the soil next to a foundation wall is filled with rubbish from the construction of the building and unless this is removed and good earth supplied it will be difficult to cause anything to grow. Given good soil and a fair amount of moisture, the Boston ivy will do its part vigorously.

Celastrus.—This is the native bitter-sweet and, while it is not a quick growing vine, it is a most excellent one. As a rule the vines do not produce any berries until they are several years old, but the winter beauty of a well-grown specimen is so great that it pays to spend some time in securing this result. In the woods the bitter-sweet will grow in partial shade and cover small shrubs and trees with its long stems. It has been observed, however, that these vines grown in the deep woods seldom produce many berries, while the plants found along the edges of the woods or on fences in the open are usually laden with their attractive seed pods. From this occurrence it would appear that it is a sort that will grow in either shade or sun, but that it produces its fruit best when it has a full exposure.

Clematis.—There are many varieties of clematis offered by nurserymen, but none of them are any prettier than our native C. virginiana. This makes a vigorous growth and bears

Bitter Sweet.

in profusion small white flowers. The flowers are produced in great feathery masses which make the plant one of our most graceful climbers. The large flowered forms are easily grown, but lack the delicate beauty which marks our native plant. C. paniculata is a newer introduction from that land of plant marvels, Japan. It is similar to our native form, but produces slightly larger flowers and at the same time loses but little of the grace of our own vine.

Lathrus.—This perennial vine greatly resembles the sweet pea. The flowers, however, are not fragrant. It will grow in any soil and makes an excellent vine where height is not desired, for, like the sweet pea, it does not grow very tall. The flowers are produced all summer and are good for cutting.

Wisteria.—Two species of wisteria grow wild in America, but the Chinese form is superior to either of them as a cultivation plant. Few vines make a more rapid growth or are more universally satisfactory. It should be planted in deep, rich soil and allowed plenty of moisture. In dry weather it is well to mulch the surface with leaves or straw to help retain moisture.

CHAPTER XIV

Shrubs

Botanically, a shrub differs from a tree in that it has many stems, while a tree has but one. From the standpoint of the gardener, however, there is no reason why a small ornamental tree should not be treated as a shrub. What is wanted is a small woody plant that is ornamental and that will not grow beyond a certain definite size.

The value of shrubs for ornamental planting can not be over estimated for no class of plants lends itself to a greater variety of effects nor is any sort of ornamental planting more permanent. Many of our best shrubs are native to this country, but it is only in recent years that gardeners have admitted this fact. Years ago the gardens of England and Europe were using great quantities of American material, while at the same time our American nurseries were listing and recommending chiefly varieties that had been introduced.

Native Shrubs.—Each year sees a still greater inclination to make use of our own material in this line and some landscape architects are building an enviable reputation chiefly through the use of native stock.

There are, of course, many valuable shrubs as well as

other plants that have been brought to us from far lands and in the course of time others will be brought. It is not the desire to minimize the usefulness of any of these, but it is desirable that our own plants of value should not be overlooked.

Soil.—When a shrub is planted it is expected that it will occupy that particular spot for some time. It is not likely that it will be moved in a year or two. It is a permanent addition to the establishment and for that reason it should be selected and planted with care. The soil should be properly prepared

The proper protection for tender shrubs in winter.

to begin with. Do not expect shrubs or any other sort of plants to grow and thrive if the preparation of the ground from which they must get their life is neglected. Most shrubs require a fertile soil if they are to make fine specimens. Do

not blame the nurseryman if your plants do not look like the pictures in the catalogues. In most cases catalogue pictures are very modest and the failure to exceed them rests entirely with yourself.

In the actual planting of a shrub use just as much care as though you were planting an apple tree from which you some day hoped to secure part of your sustenance. Have the hole dug deep enough and large enough to receive all the roots without crowding. Then see that the roots are in good condition; prune off those that are broken or damaged in any way. Set the shrub in the ground as deeply as it grew in the nursery or a trifle deeper. Throw in the top soil and tamp it well with the foot, or, better still, work it and pack it around the roots with your hands. Do not allow any air spaces below the roots, for such spaces cause the earth to dry out and may cost the life of the plant. The last soil that is used in filling the hole should not be tramped hard, but should be left loose—and kept loose.

In most cases the shrub should be pruned immediately after it is planted. In transplanting, the root system has, of course, been damaged to a considerable extent and some of the roots have been lost. Those that are left can not begin to supply moisture to the plant in its accustomed quantity and in order to balance the water supply some of the water using area of the plant must be removed. This is the only reason for pruning either a tree or a shrub at the time it is planted. The rule holds good for any sort of plant, whether it be an oak or a stalk of celery.

If the plants are not to be moved far, it is sometimes possible to transplant large well-grown shrubs without much pruning, but in such a case the work must be done at the right time and in the right way. The only satisfactory time for such work is in the winter when the ground is frozen hard. It is then possible to dig a trench around the shrub that is to be moved and pry it out of the ground with a large ball of frozen earth. In this way very few of the roots are disturbed.

It is about like setting a pot-grown plant in the garden. Even in such cases, however, the shrubs almost invariably show a tendency to make a weak growth for one or two seasons after they have been moved and the safest way for the amateur is to start with small nursery-grown plants and let them acquire size as they will.

Most shrubs grow rapidly, so that it does not take a long time for them to begin to repay the labor lavished on their planting and after care. In the following list are included only shrubs of known value and where their culture differed from the normal a note has been made of that fact.

Amelanchier (June berry).—This small tree often grows in the form of an open bush, but even where it attains tree size it is always an "under wood" in the forest. Its principal ornamental value lies in the fact that very early in the spring it is covered with a multitude of small white flowers. Before the other trees have more than started to leaf out, the June berry has thrown its cloud of misty blossoms to the April air. If grown as a shrub it must be given plenty of room so that it can develop its full beauty. As it is shade-enduring, it may be planted under larger trees with good effect.

Barberry.—The best of the barberries is the form introduced from Japan as B. thunbergii. It makes a graceful shrub if planted in the border or it may be used with fine effect as a hedge plant. The stems are quite spiny and if the plants are placed about eighteen inches apart they will form a low hedge that will turn stray dogs very effectively. One of the chief beauties of the plant lies in the fact that in winter it is covered with loads of bright red berries which retain their plumpness and color well into spring. It may be propagated by taking dormant cuttings and sticking them in the ground to a depth of several inches. These will quickly take root and in a season or two will make sizable plants. If an immediate effect is desired it is better to buy well grown plants from the nursery as quite large bushes can be transplanted with considerable success. If the larger plants are set out they should be cut back to the ground after planting. It is shade enduring.

June Berry.

Calycanthus (Sweet Shrub).—This is an old favorite for garden culture and deserves a prominent place in spite of the fact that it is not particularly ornamental and the flowers are not suited for cutting. Its popularity is due entirely to the fact that its dark, brownish red blossoms are extremely fragrant with a spicy, fruity odor not found in other plants. The twigs of the shrub, when broken, give off a very pleasant odor also. These facts, coupled with the fact that it has long been an inhabitant of our gardens, make it a shrub worth while. It will grow well in the shade of trees and this gives it an added value.

Cercis (Red Bud).—The red bud of our forests is one of our most valuable shrubs. It sometimes forms a small tree, but it is always attractive. It can be used either as a single specimen or may be planted in groups or in lines to form a screen. It blooms very early in the spring, before the leaves open, and when in full bloom is one of the most beautiful sights of the American forest. In those parts of the country where the red bud is still plentiful it forms one of the chief attractions of the spring landscape. The flowers are small, pea shaped and of a beautiful shade of pinkish lavender. They are produced in such great abundance that they fairly clothe every twig and branch of the entire tree. As they fall they are quickly followed by the glossy, heart-shaped leaves which remain in good condition all summer. By midsummer the seed pods are well grown and take on a beautiful red coppery color so that the tree is only a little less beautiful in fruit than it was in flower. The red bud can be transplanted successfully only when it is quite small. Large specimens are usually ruined by transplanting and it generally pays with this, as with most other plants, to use small healthy specimens to start with. It grows rapidly and a small tree well started will often outstrip a larger one that has had its root system damaged in handling. It will grow in the shade, but requires full sunlight to develop to perfection.

Cornus (Dogwood).—The large flowering dogwood is one of the most striking of our native trees—for it is a tree although often used for the purposes of a shrub. The branches are covered each spring with a load of large white blooms that

Red Bud.

never fail to provoke comment. Once in a long while a single tree is found in the woods bearing flowers of a delicate shade of pink. This pink flowered form is even more beautiful than its parent—for it is considered as only an offshoot from the white variety. Nurserymen now offer both kinds. In autumn the foliage of the dogwood turns from green to a deep rich red and it is then one of the most ornamental trees in the forest. Later the leaves fall and the bright red berries, produced in small clusters, stand out sharp and clear and give the tree an interesting appearance well into the late fall. This plant has so many good qualities that it should be in every ornamental collection. It is not so large but that it could be grown to perfection even within the confines of the average city yard. Certainly it takes up less room than do many of the exotic magnolias that seem to be so popular and, aside from the fact that it is a native and the magnolias are not, every argument is on the side of the dogwood. For some reason people will buy plants that are introduced from some far-off country and sold under a high-sounding name, while they leave neglected the most beautiful trees and plants of their own state. The dogwood will stand a moderate amount of shade, but in the forest it is at its best when it breaks through the edge of the timber and gets a space of sunshine all to itself.

There are other members of the dogwood group that are true shrubs. The only ones of these that are extensively cultivated are those that have red stems in winter. This red-stemmed character is the most striking feature of this group of plants and it is a valuable one because it produces a note of color in our gardens at a season of the year when color is at a premium. The American species, C. stolonifera, is a good one of this sort, but C. alba, a form introduced from Siberia, has more brilliant red stems and is the more desirable of the two for planting. Both of these have small clusters of white flowers in spring, followed by flat heads bearing white berries. They are useful shrubs, but are not to be compared with the tall-growing form first mentioned.

Corylus (Hazel nut).—The common hazel makes an excellent shrub for shady situations, doing well even under old

Dogwood

forest trees. It has many interesting features that recommend it to the planter. To begin with, it is probably the first

plant of any kind to bloom in the spring. The first warm day of early spring will bring the hazel into bloom and many lovers of the out of doors watch for it with eager eyes each year. The flowers, however, are not such as would attract attention from the average person. They are of two kinds, one producing the pollen and the other bearing the ovary from which develops the fruit. The pollen-bearing flowers are catkins which in bloom measure from two to five inches in length. The female flowers, however, are tiny tufts of pinkish pistils that might easily be overlooked. However, they are the flowers and the fact that they brave the season to make their appearance so early in the year has made the plant dear to the heart of every nature lover. The foliage of the plant is rather rough, but not unpleasant and the fruit is a delicious, though small nut. The hazel will grow in heavy shade. A northern form of it is similar except that the nuts, instead of being protected by a short envelope or husk, are situated at the base of a long leafy tube. They are interesting in appearance, but difficult to extract from their protective covering.

Crataegus (The Haws).—We have in America many varieties of the haw family and almost without exception they are deserving of more extensive cultivation. A few of them are worthy of special mention. C. mollis is one of the best because of its excellent form, its fine white bloom and its loads of red fruit. This is the only one of the haws that the average person would consider as edible, although small boys have been known to eat with relish the fruit from many kinds. The fruit of this haw ripens in August and September. It is nearly or quite three-quarters of an inch in diameter and is useful in making a clear red jelly of wonderful flavor. C. coccinea and C. punctata are both well worth the attention of the grower for both are excellent varieties. C. cordata, the Washington thorn, is one of the most valuable of the group. If allowed to take its natural shape it will form a small tree up to thirty feet in height. However, it can be and often is trimmed to a much smaller size. It makes a good hedge plant and stands trimming well. The foliage turns to a rich red in

the fall and after the leaves are off the bright red, though small, haws show up to perfection. These are produced in great abundance and remain on the tree all winter.

Cydonia (Japan quince).—This shrub is one of the early introductions from Japan and has remained fairly popular

An American haw.

although it has many bad characteristics. In early spring it produces an abundance of glowing red flowers, which are followed in late summer by the fruit, which somewhat resembles the cultivated quince and has an attractive odor. However, the plant sprouts from the root badly and unless given a great deal of care it soon makes an unsightly bush that is devoid of character. It is also very subject to the attack of the San Jose scale. If there is a scale insect within a mile of a Japan quince bush it seems to be able to locate it and settle down there. As a result these are often a source of infestation for the neighboring country. Orchardists have been known to spray their trees thoroughly and wondered how they happened to have so much scale on the trees the next fall. Too often it has happened through the fact that they had a neglected Japan quince in the dooryard.

Forsythia.—Several forms of this have been introduced and they are all valuable shrubs. Their chief value lies in the fact that they produce a wealth of clear yellow flowers very early in the spring long before other plants have started their work of brightening up the garden. It does not do well in shaded situations.

Hamamelis (Witch Hazel).—The hazel nut is the first to bloom in the spring and this, the witch hazel, the last to throw its yellow blossoms to the wind in November. They are not related, but both have their value. The individual bloom of the witch hazel is rather insignificant, but it is produced in such quantities that the whole shrub seems crowded with the yellow flowers. In nature it grows about the edges of rocky ravines, but under cultivation it adapts itself to many situations and is an admirable shrub worthy of more extended planting. The seed pods, which ripen just before the bloom appears, are one of the interesting features of the bush. The seed capsules open in such a way as to shoot the seeds some distance and with considerable force. This is one of the means by which the plant manages to distribute its seeds.

Witch Hazel.

Wild hydrangea.

Hydrangea.—The native wild hydrangea is not only a charming plant, but one of value because it can be grown in shady situations. It is a vigorous grower and will produce results in a shaded corner about as quickly as any plant that can be used. The most commonly planted horticultural variety is the H. paniculata grandiflora, with its great masses of white bloom. It is a valuable sort, but, unlike the wild kind, it must be grown in full sunlight.

Lilac.—The lilac is not a native of this country, but it has been grown here for so long that it seems as though it belonged to us. It was one of the first plants introduced and must have been brought from England and France at a very early date. It is too well known to require description and too valuable to need any advertisement of its virtues. The lilac reaches its finest development in the cooler parts of the country. On Mackinac island, Michigan, are the finest specimens of this shrub to be found any place. Doubtless the plant was brought to that section by the early missionaries, for certainly some of these specimens are very old. The older ones have a tree-like form and are of such size that they are used as hammock supports in some cases. In recent years several named

varieties of lilac have been introduced. They produce blooms larger and finer in color than the old-fashioned lilac, but without exception they lack the vigor of growth that is possessed by the original form.

Philadelphus (Syringia).—This is another favorite that deserves to be perpetuated because of its wealth of white flow-

Tree-size lilacs on Mackinac Island, Mich.

ers in the spring. In habit the shrub is not greatly to be admired and outside of the period when it is in bloom it is not a particularly beautiful object. However, it seems to withstand adverse conditions better than almost any of our shrubs and for the city back yard it is probably the one best shrub. City back yards can not be too partial about their plants anyway and it is well that some forms seem to thrive in spite of the adverse conditions. As for the better shrubs, they will revel in the cleaner air of the country.

Physocarpus (Nine bark).—This attractive plant has

been brow beaten by the botanists until it probably does not know its own name. The writer learned to know and love it under the generic name of opulaster, which has since been succeeded by that given above. It has also been classed as a spiraea, and nurserymen still offer it under that name. A golden leaved form is listed as "golden spiraea." Regardless of the name, it is a splendid plant and should be in every col-

Physocarpus.

lection of shrubs. The branches rise from the ground with a graceful sweep and in spring are covered with white blooms. Later seed pods take the place of these blooms and the plant is then almost as attractive as it was when the flowers were at their best. It is a quick growing form and one that will succeed in many soils and situations.

Rhododendron.—The rhododendrons, kalmias, azaleas

and others of this group make wonderful plants for the snrubbery or for massing against a house or under trees, but they are among the most difficult of all plants to grow. They may be grown almost any place, however, if the bed is properly prepared for them. They grow naturally in a soil composed almost entirely of peat and where this material can be obtained rhododendrons and their allies can be produced. Excavate the place where they are to stand to a depth of at least three feet and fill the bottom with broken stone unless there is a gravel subsoil to provide good drainage. Then fill the excavation with peat mixed with in the soil and if this element is present in any quantity in the surrounding soil it will eventually work into the bed of peat and ruin the planting. To prevent this it is sometimes advisable to build a thin-walled concrete pit, coat the walls with pitch to keep out the soil water and then fill with peat in the usual way. The plants will do better in a shaded situation, such as the north side of a house and the surface of the soil should at all times be mulched with a layer of leaves to help retain moisture. Some plant growers have at times claimed to have a "secret" for growing rhododendrons and have treated the beds with a chemical to make the soil suitable for the plants. This chemical is usually magnesium sulphate which when carefully used has been known to be of assistance in growing these evergreens on soil that would otherwise promptly kill them. Just as often the use of this or other chemicals has resulted in the very prompt death of valuable plants. There is no secret about growing this beautiful class of shrubs, simply plant them in peat and they will grow.

Rose.—It is presumptous to attempt to deal with rose growing in the brief space of a paragraph. There are some four or five thousand varieties of roses under cultivation now and single growers list as many as eight hundred different kinds. Our native wild roses are not particularly rich in garden material when compared with the wonderful horticultural varieties that are offered by the trade. Some of the native

forms are of value when they can be used along fences on large estates, but for the most part they are too rank in growth to be desirable in the average garden. The sweet brier is an old favorite, and though not a native, it has escaped from cul-

Native American roses.

tivation and is to be found in many old fields and pastures. It is valued for the fragrance of its foliage and for the bright red "hips" that remain on all winter. The list of climbing roses contain some sorts that are exceedingly beautiful. The crimson rambler has long been a favorite in spite of the fact that its color is against it. The Dorothy Perkins is just as good a climber and the color of its flowers is far superior to that of the older form. A rather new rose is the American pillar, a climber of great vigor. The flowers are single, of a delicate shade of pink with a white eye. It is still further to be desired by the fact that it has unusually handsome foliage that remains bright and green until cold weather. It is quite hardy except in very severe winters. The following notes on starting a rose garden are taken from a publication of the Missouri Botanical Garden:

Location.—Roses are entitled to the choicest location in a yard. Good exposure to the sun, and proper protection from prevailing winds will do much to make the rose garden a success. While a location with a full-day sun exposure is much to be preferred, it is not absolutely essential, and where a choice must be made it is best to give roses the morning sun. Buds should not be located near trees or shrubbery. Roses are heavy feeders and for their best development require an unusual amount of fertilizer; when planted near trees or shrubbery, the roots of the latter deplete the soil of nourishment, with the result that the roses suffer. If, however, planting in close proximity to trees and shrubs is unavoidable, it is advisable each year to dig a trench (about a foot wide and two or three feet deep) around the rose bed and fill with well-rotted cow manure. This procedure will tend to prevent the roots of shrubs from actually entering the rose bed. Sometimes a concrete wall is constructed deep enough to prevent this encroachment.

Soil.—Roses usually do well in any good garden soil, but better results are obtained if considerable care is exercised in the preparation of the ground. Roses require a heavy, well-

drained soil. To obtain this, the area to be used for a bed should be dug out to a depth of from eighteen inches to two feet, and if the drainage is not good another six inches should be removed and this space filled with fine broken stone, brick,

American Pillar Rose.

or old flower-pots. Upon this porous stratum six inches of well-rotted cow manure should be placed, and finally sufficient heavy soil to finish the bed, raising it not more than three inches above the surrounding grade. This latter layer should, if possible, be top soil (including sod) from an old pasture. After making the bed it should be allowed to settle for a week before the planting is begun.

Planting.—Roses may be set out either in the fall or in the spring. The spacing depends very largely upon the variety; tea and hybrid tea varieties may be planted about eighteen inches apart, but hybrid perpetuals, on account of their more vigorous growth, should be spaced at least two and one-half feet, and ramblers eventually need about four feet. In any case an eight-inch margin from the edge of the bed should be allowed. Where potted stock is being planted, the ball of earth should be placed with its upper surface about two inches below the soil; field-grown stock may be set two or three inches lower than its former position in the nursery. The holes for receiving the plants should be large enough to admit the stock without bending or crowding the roots, the soil should be firmly packed around the roots, and the plants thoroughly watered immediately after planting. All stock should be so pruned that but two or three buds remain on each shoot —the upper bud, in each case, pointing outward.

Spiraea.—There are numbers of spiraeas listed by the plant dealers, but of the entire lot one stands out as being far and away the best. This is the spiraea Van Houtii, which has many points to recommend it. It blooms early in the season, producing a great mass of delicate white. Its brancnes are long and drooping, giving it a graceful appearance not exceeded by any plant of its type. Also it is a quick grower and will produce results in a short time. Probably no other shrub is so largely planted as a foundation screen. S. Anthony Waterer is another good introduction, producing heads of brilliant red flowers and blooming from July until frost. It is stiff and erect in habit as compared to the first named.

Symphoricarpus.—This genus contains just two shrubs, both native and both of decided value. One is the snowberry, a delicate little shrub with long, slender branches. Early in summer the plants are covered with an abundance of tiny pink, bell-shaped flowers, which are later followed by clusters of the most beautiful waxy white berries. These remain on the shrub until cold weather causes them to darken and shrivel. The other plant is the Indian currant, a more robust form than the snowberry, although only growing about thirty inches high at the most. It is covered in the fall with masses of small, dull red berries that might be imagined to resemble currants. The plant is ornamental from the standpoint of form and the berries remain on all winter and give color to the planting just when it is most needed. Both of these forms are made more valuable by the fact that they withstand a considerable amount of shade.

The black haw, one of the viburnums, makes an attractive large bush.

The always welcome "Pussy Willow."

Viburnum.—Probably the best known of the viburnums is that form which is known as the "snowball." It makes an attractive large shrub and, with the syringa, is one of the best shrubs for city planting. The maple-leaved viburnum is good for shady situations. It has flat heads of white flowers, followed in the fall by dark bluish-black berries. The "black haw" is a viburnum and a splendid one too. It makes a large bush and is a desirable form to use where it can be given plenty of room. The fruit, which certainly does not resemble a haw in the least, is, nevertheless, edible.

Weigela.—This was one of the first plants introduced from the orient and has been tested out through a period of at least seventy-five years. It is still a valuable shrub and, although many horticultural varieties are offered, the old rosy pink species is still as reliable as any of them. It blooms early in the summer, producing a great mass of bloom on its curved branches. It delights in full sunlight.

Willow.—No list of shrubs and no hardy garden should be complete without a "pussy willow". Although this is technically a tree and will do its best to grow into a tree, it can be kept a shrub by the simple process of keeping it cut back to the ground every few years. Such treatment seems cruel to an ambitious plant, but it is the pussy willow, the shrub, that we desire and not pussy willow, the tree. No other feature of the early spring is more delightful than the soft, silvery-grey catkins on the willow twigs. They are among the "harbingers of spring" that we learn to look forward to with joy and expectation and when they appear we feel that the season of growth is indeed close to us and we can expect before long to see the flood of green sweeping back over the trees and turning our dreary world again into a place of sunshine and of song.

APPENDIX.

Grafting Wax.

Grafting wax is made as follows:

Melt together four ounces of resin, two ounces of beeswax and one ounce of tallow. When it is thoroughly melted and mixed, pour it into a pail of cold water and pull it as you would molasses candy. Grease your hands well with tallow before attempting to pull it. If it should become lumpy, melt it over again and let it heat somewhat hotter than it did the first time. After it has been pulled it should develop a smooth texture and a lighter color—just as molasses candy does.

The tallow should be good beef or mutton tallow. Crisco, a vegetable substitute for lard sold for cooking, can be used in place of the tallow and makes an excellent grafting wax. It is usually more easily obtained than is pure tallow.

By the addition of a small amount of linseed oil to the above wax while it is still melted, its normal melting point can be lowered. Such wax should not be pulled, but should be kept in a metal pot similar to a glue pot, in which it can be heated and applied to cut surfaces with a paint brush.

Number of Plants Required to Set One Acre.

1x1 foot	43,560	2x4 feet	5,445
1x2 feet	21,780	3x3 feet	4,840
1x3 feet	14,520	3x4 feet	3,630
1x4 feet	10,890	3x6 feet	2,420
2x2 feet	10,890	3x8 feet	1,815
2x3 feet	7,260	4x4 feet	2,722
2x2 feet 6 inches	8,712	4x6 feet	1,185
2x3 feet 6 inches	6,223	5x5 feet	1,742

5x8 feet	1,089	20x20 feet	108
6x6 feet	1,210	20x30 feet	72
6x8 feet	907	24x24 feet	75
8x8 feet	680	25x25 feet	69
8x10 feet	544	30x30 feet	49
10x10 feet	435	32x32 feet	42
10x12 feet	363	33x33 feet	40
12x12 feet	302	34x34 feet	37
12x16 feet	226	36x36 feet	33
15x15 feet	193	38x38 feet	30
16x16 feet	170	40x40 feet	27
18x18 feet	134		

AMOUNT OF SEED REQUIRED TO SOW 100 FEET OF DRILL.

Beet	1 oz.	Parsley	1 oz.
Beans (bush)	1 pt.	Parsnip	½ oz.
Carrot	½ oz.	Peas	1 qt.
Chard	1 oz.	Radish	1 oz.
Okra	2 oz.	Spinach	1 oz.
Onion seed	1 oz.	Turnip	½ oz.
Onion sets	1 qt.		

PACKING TABLE FOR BOXED APPLES.

Diameter in Inches	Style Pack	Packed Flat Unless Marked	No. Apples Per Row	No. of Layers	Apples in Box	Standard Boxes Unless Marked
2¼	5 Straight	———	9-9	5	225	Special
2⅜	5 Straight	———	8-8	5	200	———
2½	3-2	———	8-7	5	188	———
2⅝	3-2	———	7-7	5	175	Special
2⅝	3-2	———	7-6	5	163	———
2¾	3-2	———	6-6	5	150	———
2¾	3-2	———	6-6	5	150	Special
2⅞	3-2	———	5-5	5	125	———
3	2-2	*Side	7-7	4	112	Special
3⅛	2-2	Side	7-7	4	112	Special
3⅛	2-2	Side	7-6	4	104	———

*Pack 4 to 6 apples flat at the alternate end of each layer.

3¼	2-2	Side	6-6	4	96	———
3¼	2-2	———	6-6	4	96	———
3⅜	2-2	———	5-5	4	80	———
3½	2-2	———	5-4	4	72	———
3⅝	2-2	———	4-4	4	64	———
3¾	2-2	———	4-3	4	56	———
3¾	3 Straight	Side	6-6	3	54	Special
3⅞	3 Straight	Side	5-5	3	45	———

Note that all apples are packed flat in standard boxes unless designated otherwise.

The above table is one prepared by Purdue University.

INDEX

Achilea ---- 306
Acroclinium ---- 293
Ageratum ---- 293
Alyssum ---- 293
Amelanchier ---- 330
American Grapes ---- 16
Ampelopsis ---- 324
Anemone ---- 307
Annual flowers ---- 291
Anthracnose ---- 96
Antirrhinium ---- 293
Aphis ---- 73, 227
  lion ---- 78
  peach ---- 96
Apple—
  aphis, green ---- 73
  aphis, rosy ---- 74
  barrels ---- 141
  boxes ---- 138
  harvesting ---- 132
  packages ---- 138
  pruning ---- 49
  scab ---- 82
  storage ---- 239
  varieties ---- 10
April ---- 263
Aqulegia ---- 307
Arsenate of lead ---- 104
Asclepias ---- 308
Asparagus ---- 171, 251
Associations of fruit growers ---- 150
Asters ---- 294, 308
August ---- 271

Bacteria ---- 81
Balloon vine ---- 303
Balsam ---- 294
Barberry ---- 330
Bark beetle ---- 66
Barrels ---- 141, 143
Beans ---- 181, 252
Beets ---- 173, 252
  storage ---- 239
Beneficial insects ---- 77
Bitter rot ---- 83
Bittersweet ---- 324
Blackberry ---- 14, 127
Black knot ---- 94
Black peach aphis ---- 75
Black rot ---- 84
  of grapes ---- 94
Blight ---- 86
Blister beetles ---- 78
Blotch ---- 85
Blue flee beetle ---- 67
Bordeaux mixture ---- 105
Borer—
  peach ---- 62
  apple ---- 63
  stalk ---- 223
Box apples ---- 140
  packing table for ---- 352
Brown rot ---- 91
Buds ---- 20
Budding ---- 19
Bud moth ---- 65
Bud sticks ---- 20

Cabbage ---- 182, 252
  Chinese ---- 184
  worm ---- 240
Calendar for orchard and garden ---- 257
Calendula ---- 294

Callyopsis ---------- 295
Calycanthus ---------- 332
Campanula ---------- 309
Candytuft ---------- 295
Canker worm ---------- 65
Canning crops ----------195, 197
Carrots ---------- 252
Castor bean ---------- 301
Caterpillar—
  tent ---------- 65
  yellow necked ---------- 65
Cauliflower ---------- 186
Celastrus ---------- 324
Celery ---------- 205
  blanching ---------- 206
  storage ---------- 239
  transplanting ---------- 206
Cellar storage ---------- 233
Celosia ---------- 295
Centaurea ---------- 295
Cercis ----------332
Chard ---------- 173
Cherry ---------- 12
  picking ---------- 135
  pruning ---------- 54
Chewing insects ---------- 57
Chrysanthemum ---------- 309
Clematus ---------- 324
Clover ---------- 287
Coal oil emulsion ---------- 103
Cobaea ---------- 303
Cockscomb ---------- 295
Codling moth ---------- 57
Cold frame ---------- 214
Collards ---------- 186
Colorado potato beetle ---------- 226
Columbine ---------- 307
Commission men ---------- 149
Concrete cellars ---------- 234
Coreopsis ---------- 310
Corn ----------186, 201, 252
  ear worm ---------- 220
Corn salad ---------- 174
Corn flower ---------- 295
Cornus ---------- 333
Corylus ---------- 335
Cosmos ---------- 295
Cover crops ---------- 33
Crataegus ---------- 336
Cross fertilization ---------- 15
Crown gall ---------- 90
Cucumber ----------187, 253
  beetle ---------- 225
Cultivation ---------- 30
Curculio ---------- 61
Currant ---------- 14
  borer ---------- 128
  soil ---------- 128
  worm ---------- 63
Cuttings ---------- 22
Cydonia ---------- 337

Daffodils ---------- 323
Darwin tulips ---------- 323
December ---------- 279
Delphiniums ---------- 310
Dehorning peaches ---------- 52
Diseases of plants ---------- 81
Distance for planting ---------- 8
Division of roots ---------- 22
Dodecatheon ---------- 316
Dogwood ---------- 333
Dolichos ---------- 303
Double crops ---------- 162
Drainage ---------- 25
Dusting ---------- 109
Dust mulch ---------- 32
Dutch bulbs ---------- 323

Echinocystis ---------- 303
Egg plant ---------- 188
Escholtzia ---------- 296
Euphorbia ---------- 296

February ---------- 259
Fence for garden ---------- 162
Fertilization of bloom -----15, 166

Fertilizers ---- 29
garden ---- 158
Filler trees ---- 4
Flea beetle ---- 67, 225
Flower structure ---- 165
Flowers ---- 281
annual ---- 291
Fly speck fungus ---- 86
Forcing ---- 208
Formalin ---- 203
Forsythia ---- 338
Four-o-clock ---- 296
Frost ---- 2
Fruit storage ---- 229
Fruit tree bark beetle ---- 66
Fungi ---- 82
Fungicides ---- 105

Gardens ---- 155
arrangement ---- 157
double crops in ---- 162
fence ---- 162
fertilizers ---- 158
flower ---- 281
insects ---- 219
location ---- 157
seeds ---- 165, 167
soil ---- 157
vacant lot ---- 156, 241
Garden huckleberry ---- 129
Globe amaranth ---- 297
Golden glow ---- 318
Gooseberry ---- 14, 128
Grafting ---- 17
wax ---- 48, 351
Grape ---- 12
black rot ---- 94
berry moth ---- 63
leaf hopper ---- 76
packing ---- 145
phyloxera ---- 76
pruning ---- 54
scale ---- 68
Grass ---- 287
Greenhouse management ---- 207
Grub worm ---- 67

Hairy root ---- 90
Hamamelis ---- 338
Harlequin bug ---- 227
Harvesting ---- 131
Haw ---- 336
Hazel ---- 335
Heeling in ---- 37
Helianthus ---- 297
Helichrysum ---- 297
Hepatica ---- 311
Himalaya berry ---- 129
Hollyhocks ---- 311
Home hampers ---- 197
Horticultural values ---- 16
Hot beds ---- 212
House plants ---- 214
Huckleberry, garden ---- 129
Humulus ---- 303
Hyacinth bean ---- 303
Hydrangea ---- 340
Hydrometer ---- 101

Illinois canker ---- 90
Imported cabbage worm ---- 220
Insects ---- 57
beneficial ---- 77
garden ---- 219
Insecticides ---- 100
Ipomoea ---- 303
Iris ---- 313

January ---- 257
Japanese hop ---- 303
Japan quince ---- 337
July ---- 269
June ---- 267
June berry ---- 330

Kaiser bug ---- 228
Kale ---- 188, 253

Knifin system ---- 54
Kochia ---- 297

Lady birds ---- 77
Larkspur ---- 298, 310
Lathrus ---- 326
Lawns ---- 286
Layering ---- 22
Leaf curl ---- 92
  spot ---- 94
Lesser apple worm ---- 61
Lettuce ---- 174, 253
  varieties ---- 176
Lilac ---- 340
Lime sulphur ---- 100
  self-boiled ---- 107
  commercial ---- 108
Linum ---- 314
Lobelia ---- 314
Location for orchard ---- 1

March ---- 261
Marigold ---- 298
Marketing ---- 147
  apples ---- 151
  by post ---- 151
  cost ---- 148
  methods ---- 147
  perishable fruits ---- 151
Manure ---- 29, 158
May ---- 265
Middlemen ---- 149
Mignonette ---- 299
Miscible oil ---- 103
Monarda ---- 314
Morning glory ---- 303
Mushrooms ---- 215
Muskmelon ---- 189

Narcissus ---- 313
Nasturtium ---- 304
New Zealand spinach ---- 190
Nicotine ---- 102
Ninebark ---- 341
Nitrogen ---- 29
November ---- 277
Number of plants to acre ---- 351
Nozzles ---- 111

October ---- 275
Oil sprays ---- 103
Okra ---- 190
Onions ---- 176, 253
  storage ---- 239
Orchard—
  location ---- 1, 3
  roads ---- 1
  slope ---- 3
  soil ---- 2, 26
Oyster shell scale ---- 70

Painting wounds ---- 47
Pansy ---- 299
Parasites ---- 79
Paris green ---- 105
Parsley ---- 177
Parsnip ---- 177, 253
  storage ---- 239
Peach ---- 10
  aphis ---- 75
  borer ---- 62
  fillers ---- 6
  harvesting ---- 134
  packages ---- 145
  pruning ---- 51
  scab ---- 91
  yellows ---- 92
Pears ---- 10
  harvesting ---- 134
  pruning ---- 54
  slug ---- 65
  storage ---- 239
Peas ---- 177, 253
  for canning ---- 200
  sugar ---- 178
Pedigreed trees ---- 23

Penstemon ---- 314
Peonies ---- 315
Peppers ---- 192
Perennials ---- 305
Petunia ---- 300
Philadelphus ---- 341
Phlox ---- 300, 316
Phosphorus ---- 30
Plylloxera ---- 76
Physocarpus ---- 341
Physostegia ---- 318
Planting ---- 42
  plans ---- 4
  small fruit ---- 43
  distance ---- 8
Plant diseases ---- 81
Plant lice ---- 73
Plums ---- 12, 54
  curculio ---- 61
  harvesting ---- 135
Poisons ---- 57
Pollen ---- 16
Poppies ---- 301
  California ---- 296
Portulaca ---- 301
Potash ---- 29
Potatoes ---- 192, 254
  beetle ---- 226
  cultivation ---- 204
  early ---- 205
  for market ---- 201
  formalin treatment ---- 203
  harvesting ---- 135
  planting ---- 204
  scab ---- 201
  seed ---- 201
  storage ---- 240
  sweet ---- 192
Pruning ---- 45
  apple ---- 49
  cherry ---- 54
  grapes ---- 54
  peach ---- 51
Pruning—
  pear ---- 54
  plum ---- 54
  time to prune ---- 46

Radish ---- 178, 254
Rag doll seed tester ---- 169
Raspberries ---- 14, 124
  pruning ---- 127
Red bud ---- 332
Rhododendron ---- 342
Rhodanthe ---- 301
Ricinus ---- 301
Roads ---- 1
Root grafts ---- 17
Root division ---- 22
Roots ---- 42
Rose ---- 343
Rudbeckia ---- 318
Rye ---- 30, 35

Salvia ---- 301
San Jose scale ---- 67
Scab ---- 82
  potato ---- 201
Scabiosa ---- 302
Scale control ---- 70
Scarlet sage ---- 301
Scions ---- 17, 165
Scurfy scale ---- 70
Seed ---- 165
  advantage of large ---- 167
  amount needed for 100 ft. of row ---- 352
  buying ---- 168
  saving ---- 168
  testing ---- 169
Seedlings ---- 15
Selecting trees ---- 37
September ---- 273
Shot hole fungus ---- 94
Shrubs ---- 327
Slope ---- 3

Slug, pear ---- 65
Small fruit ---- 119
  packing ---- 145
  soil ---- 119
  time to plant ---- 120
Soil ---- 2, 25, 157, 196, 211
Soil preparation ---- 37, 119
Sooty blotch ---- 86
Spiraea ---- 347
Spraying ---- 99
Spray materials ---- 100
  machinery ---- 109
Squash ---- 192, 254
  bug ---- 226
Staking ---- 39
Stalk borer ---- 223
Stocks ---- 302
Storage ---- 229
Strawberries ---- 13
  everbearing ---- 124
  leaf spot ---- 96
  mulch ---- 123
  planting ---- 43
  varieties ---- 122
Strawflower ---- 297
Sucking insects ---- 57, 67
Sunflower ---- 297
Sun scald ---- 88
Sweet corn ---- 186, 201
Sweet peas ---- 304
Sweet potato ---- 192
Sweet shrub ---- 332
Symphoricarpus ---- 348
Syringa ---- 341

Temperature ---- 2
Tent caterpillars ---- 65
Testing seed ---- 169
Tobacco ---- 102
Tomato ---- 198, 254
Tomato—
  growing plants ---- 198
  cultivating ---- 200
  transplanting ---- 199
  varieties ---- 200
  worm ---- 223
Top grafting ---- 18
Tradescantia ---- 318
Tree selection ---- 37
Trillium ---- 319
Tulip ---- 323

Varieties ---- 10
  development of ---- 167
  horticultural ---- 16
Vegetable storage ---- 229
Verbena ---- 302
  venosa ---- 320
Vetch ---- 35
Viburnum ---- 350
Vines ---- 303

Watermelon ---- 190
Water supply ---- 3
Weeds ---- 32, 288
Weigela ---- 350
Whip grafts ---- 17
White grubs ---- 67, 224
Willow ---- 350
Wisteria ---- 326
Witch hazel ---- 338
Women pickers ---- 137
Woolly aphis ---- 75

Xeranthemum ---- 302

Yellow necked caterpillar ---- 65
Yellows, peach ---- 92
Yucca ---- 320

Zinnia ---- 302